PHYSIOLOGICAL ASPECTS OF PEANUT (*Arachis hypogaea* L.) YIELD AS AFFECTED BY DAMINOZIDE

By

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TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS ii

LIST OF TABLES vi

LIST OF FIGURES ix

ABSTRACT xiv

INTRODUCTION 1

LITERATURE REVIEW 3

  Yield Trend in Florida 3
  Physiological Aspects of Peanut Yield and Yield Differences 5
  Plant Reproductive Characteristics 12
    Flower Formation 12
    Peg Initiation and Elongation 14
    Pod Initiation 17
    Seed Number Determination 19
  Kylar 19
  Response of Peanuts to Kylar 26

MATERIALS AND METHODS 32

  Description of the Chemical 32
  General Information 32
  Description of Field Studies 35
  Application of Kylar 38
  Sampling 39
  Description of Laboratory Studies 41
  Statistical Analyses 43

RESULTS AND DISCUSSION 44

  The 1978 and 1979 Experimental Conditions 44
    Weather 44
    Planting Date 47
    Diseases 47
  The 1978 Experiment 47
    Ground-Cover and Leaf Area Index 47
    Flowering 51
    Peg Number 51
    Pod Number 54

Page

Crop Growth 60
Growth Rate 60
Partitioning of Assimilates 83
The 1979 Experiment 87
Growth Analysis 87
Ground cover and leaf area index 87
Flowering 95
Pegging 96
Pod formation and pod fill 96
Stem length 103
Growth Analysis 109
Partitioning of Assimilates 138
Filling Period 141
Shelling Percentages 141
Yield Aspects 142

SUMMARY AND CONCLUSIONS 147

LITERATURE CITED 149

APPENDIX A 157

APPENDIX B 166

BIOGRAPHICAL SKETCH 174

LIST OF TABLES

Table Page

1 The composition of Kylar-85 ... 34

2 Schedule of Kylar application, treatments, and the corresponding plant development in 1978 ... 37

3 Schedule of Kylar application, treatments, and the corresponding plant development in 1979 ... 38

4 The pH, double-acid extractable and exchangeable nutrients, ECEC, total acidity organic matter percentage, and total nitrogen in soil from the 1979 experimental area* ... 40

5 The effect of Kylar on leaf area index (LAI) and specific leaf weight (SLW) of Dixie Runner (DR) peanuts during the 1978 growing season ... 49

6 The effect of Kylar on leaf area index (LAI) and specific leaf weight (SLW) of Florunner (FR) peanuts during the 1978 growing season ... 50

7 The effect of Kylar on the flowering of Dixie Runner (DR) peanuts during the 1978 growing season ... 52

8 The effect of Kylar on the flowering of Florunner (FR) peanuts during the 1978 growing season ... 53

9 Effect of Kylar on main stems and branches of Dixie Runner peanuts during the 1978 growing season ... 61

10 Effect of Kylar on main stems and branch length of Florunner peanuts during the 1978 growing season ... 62

11 Effect of Kylar on pod weight when applied at different growth stages of Dixie Runner peanut in 1978 ... 64

12 Effect of Kylar on pod dry weight when at different growth stages of Florunner peanut in 1978 ... 65

13 Linear regression equations indicating the effect of Kylar on crop growth rate and pod growth rate expressed in kg/ha/day, when applied at different growth stages of the Dixie Runner peanuts in 1978 ... 80

Table Page

14 Linear regression equations indicating the effect of Kylar on crop-growth rate, and pod-growth rate expressed in kg/ha/day, when applied at different growth stages of the Florunner peanuts in 1978 81

15 The effect of Kylar on partitioning factors of Dixie Runner and Florunner cultivars during the 1978 growing season 84

16 The effect of Kylar on the length of the filling period when applied at different growth stages of Dixie Runner and Florunner peanuts in 1978 85

17 Final yield of Dixie Runner and Florunner peanuts during the 1978 growing season 86

18 Average weekly dry weight of components of Dixie Runner (DR$_C$) peanuts during the 1979 growing season 115

19 Average weekly dry weight of components of Dixie Runner (DR$_{45}$) peanuts during the 1979 growing season 116

20 Average weekly dry weight of components of Dixie Runner (DR$_{87}$) during the 1979 growing season 117

21 Average weekly dry weight of components of Florunner (FR$_C$) peanuts during the 1979 growing season 124

22 Average weekly dry weight of components of Florunner (FR$_{45}$) during the 1979 growing season 125

23 Average weekly dry weight of components of Florunner (FR$_{87}$) peanuts during the 1979 growing season 126

24 Effect of Kylar on main stem and branches for the different treatments during the 1979 growing season 127

25 Root, stem, leaf, and pod dry weight percentages for Dixie Runner (DR$_C$) peanuts during the 1979 growing season 128

26 Root, stem, leaf, and pod dry weight percentages for Dixie Runner (DR$_{45}$) peanuts during the 1979 growing season 129

27 Root, stem, leaf, and pod dry weight percentages for Dixie Runner (DR$_{87}$) peanuts during the 1979 growing season 130

28 Root, stem, leaf, and pod dry weight percentages for Florunner (FR$_C$) peanuts during the 1979 growing season 132

Table Page

29 Root, stem, leaf, and pod dry weight percentages for Florunner (FR_{45}) peanuts during the 1979 growing season 133

30 Root, stem, leaf, and pod dry weight percentages for Florunner (FR_{87}) peanuts during the 1979 growing season 134

31 Crop growth rates, pod growth rates, partitioning factors, and final yields for the different treatments during the 1979 experiment 135

32 Pod number increase rate, average pod weight, filling period, and shelling percentage for Dixie Runner and Florunner when Kylar was applied at different growth stages in 1979 136

33 Regression equation analyses for the crop growth rate and pod growth rate of Dixie Runner and Florunner during the 1979 growing season 139

Appendix A Tables

A-1 Effect of Kylar on peg number when applied at different growth stages of Dixie Runner peanut in 1978 158

A-2 Effect of Kylar on peg number when applied at different growth stages of Florunner peanut in 1978 159

A-3 Effect of Kylar on pod number when applied at different growth stages of Dixie Runner peanut in 1978 for the one-plant samples 160

A-4 Effect of Kylar on pod number when applied at different growth stages of the Dixie Runner peanut in 1978 for the three-plant samples 161

A-5 Effect of Kylar on pod number when applied at different growth stages of Florunner peanut in 1978 for the one-plant samples 162

A-6 Effect of Kylar on pod number when applied at different growth stages of Florunner peanut in 1978 for the three-plant samples 163

A-7 Weekly flower count for Dixie Runner during the 1979 growing season 164

A-8 Weekly flower count for Florunner during the 1979 growing season 165

LIST OF FIGURES

Figure		Page
1	Chemical formula structure of succinic acid 2-2-dimethylhydrazide	33
2	Average weekly solar radiation, average weekly temperature, and total weekly precipitation for the 1978 growing season	45
3	Average weekly solar radiation, average weekly temperature, and total weekly precipitation for the 1979 growing season	46
4	Bi-weekly number of pegs for Dixie Runner peanut receiving different treatments of Kylar during the 1978 growing season	56
5	Bi-weekly number of pegs for Florunner peanut receiving different treatments of Kylar during the 1978 growing season	56
6	Bi-weekly number of pods for Dixie Runner peanut receiving different treatments of Kylar during the 1978 growing season	57
7	Bi-weekly number of pods for Florunner peanut receiving different treatments of Kylar during the 1978 growing season	59
8	Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for control treatment on Dixie Runner peanut during the 1978 growing season	66
9	Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{30} treatment on Dixie Runner peanut during the 1978 growing season	67
10	Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{44} treatment on Dixie Runner peanut during the 1978 growing season	68

Figure Page

11 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{58} treatment on Dixie Runner peanut during the 1978 growing season . . . 69

12 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{72} treatment on Dixie Runner peanut during the 1978 growing season . . . 70

13 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{86} treatment on Dixie Runner peanut during the 1978 growing season . . . 71

14 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{100} treatment on Dixie Runner peanut during the 1978 growing season . . . 72

15 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR_C treatment on Florunner peanut during the 1978 growing season . . . 73

16 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR_{30} treatment on Florunner peanut during the 1978 growing season . . . 74

17 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR_{44} treatment on Florunner peanut during the 1978 growing season . . . 75

18 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR_{58} treatment on Florunner peanut during the 1978 growing season . . . 76

19 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR_{72} treatment on Florunner peanut during the 1978 growing season . . . 77

20 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR_{86} treatment on Florunner peanut during the 1978 growing season . . . 78

Figure Page

21 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{100}$ treatment on Florunner peanut during the 1979 growing season 79

22 Leaf area index during the 1979 growing season for Dixie Runner treatments 89

23 Leaf area index during the 1979 growing season for Florunner treatments 90

24 Specific leaf weight measured weekly during the 1979 growing season for the Dixie Runner cultivar treatments 93

25 Specific leaf weight measured weekly during the 1979 growing season for the Florunner cultivar treatments 94

26 Weekly number of flowers for Dixie Runner treatments during the 1979 growing season 97

27 Weekly number of flowers for Florunner treatments during the 1979 growing season 98

28 Weekly number of pegs for Dixie Runner treatments during the 1979 growing season 100

29 Weekly number of pegs for Florunner treatments during the 1979 growing season 101

30 Weekly number of pods for Dixie Runner treatments during the 1979 growing season 102

31 Weekly number of pods for Florunner treatments during the 1979 growing season 104

32 Length of the main stem of Dixie Runner treatments measured weekly during the 1979 growing season 105

33 Length of the main stem of Florunner treatments measured weekly during the 1979 growing season 106

34 Average length of the eight longest branches of Dixie Runner treatments, measured weekly during the 1979 growing season 107

35 Average length of the eight longest branches of Florunner treatments, measured weekly during the 1979 growing season 108

Figure Page

36 Total biomass dry weight (T) partitioning into vegetative (V) and pod (P) components for control treatment on Dixie Runner peanut during the 1979 growing season 111

37 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for DR_{45} treatment on Dixie Runner peanut during the 1979 growing season 113

38 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for DR_{87} treatment on Dixie Runner peanut during the 1979 growing season 114

39 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for control treatment on Florunner peanut during the 1979 growing season 120

40 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for FR_{45} treatment on Florunner peanut during the 1979 growing season 121

41 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for FR_{87} treatment on Florunner peanut during the 1979 growing season . 122

Appendix B Figures

B-1 Comparative total dry weight curves for Dixie Runner DR_C, DR_{45}, DR_{87}, during the 1979 growing season 167

B-2 Comparative vegetative dry weight curves for Dixie Runner treatments: DR_C, DR_{45}, DR_{87}, during the 1979 growing season 168

B-3 Comparative pod dry weight curves for Dixie Runner treatments: DR_C, DR_{45}, DR_{87}, during the 1979 growing season 169

B-4 Comparative total dry weight curves for Florunner treatments: FR_C, FR_{45}, FR_{87}, during the 1979 growing season 170

B-5 Comparative vegetative dry weight curves for Florunner treatments: FR_C, FR_{45}, FR_{87}, during the 1979 growing season 171

Figure Page

B-6 Comparative pod dry weight curves for Florunner treatments FR_C, FR_{45}, and FR_{67}, during the 1975 growing season 172

B-7 Comparative pod dry weight curves for Dixie Runner control, Dixie Runner DR_{45} treatment, and Florunner control during the 1979 growing season 173

Abstract of Dissertation Presented to the Graduate
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PHYSIOLOGICAL ASPECTS OF PEANUT (*Arachis hypogaea* L.) YIELD AS AFFECTED BY DAMINOZIDE

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During the 1978 and 1979 growing seasons, growth analyses were conducted to study the effect of Daminozide called Kylar-85 (succinic acid-2,2-dimethylhydrazide) on low partitioning (Dixie Runner) vs high partitioning (Florunner) peanut cultivars. The objective of the study was to test the hypothesis that the use of Kylar to suppress the vegetative growth of low partitioning peanut (Dixie Runner) would result in the increased partitioning of photosynthate from vegetative plant parts to the fruits

The results indicated that Kylar did not affect leaf area index (LAI), flower, and peg initiation for either Dixie Runner or Florunner, however, it did slightly increase the specific leaf weight (SLW) of the Dixie Runner cultivar. Kylar reduced the vegetative growth of both Dixie Runner and Florunner in terms of stem length. The leaves of Kylar-treated peanuts appeared darker green than the control. Kylar

seemed to increase the resistance of Dixie Runner cultivar to Cercospora leaf spot.

The effect of Kylar on crop-growth rates between and within cultivars was not statistically significant at the 0.05 level. The average rate of accumulation of total dry matter by the vegetative parts was similar for all treatments. Kylar significantly increased the pod-growth rate in Dixie Runner peanuts. The most striking response of the Kylar treatment was the marked increase in pod number.

Partitioning of photosynthate to the fruits was increased. Yields from Kylar-treated Dixie Runner peanuts were comparable to treated and untreated Florunner.

INTRODUCTION

The variation in the potential yields of peanut varieties (Arachis hypogaea L.) results from physiological differences among the cultivars (Duncan et al., 1978). Better understanding of the physiological differences should aid in future progress in yield improvement.

An old, lower-yielding peanut cultivar (Dixie Runner) exhibits an indeterminate growth habit with flowering beginning 4 to 5 weeks after planting and extending to harvest or the first killing frost. Smith (1954) stated that flowering did not terminate in the cultivars he studied until the plants were killed by frost. Cahaner and Ashri (1974) noted that peanut plants are characterized by indeterminate growth and continuous flowering. Duncan et al. (1978) reported that branches of Dixie Runner continued to grow until maturity, although at a slower rate after fruit establishment.

The new higher-yielding peanut cultivar (Florunner) is characterized by more determinate growth, and flowering does not likely continue until harvest. Duncan et al. (1978) noted that Florunner branches did not grow at all after fruit establishment. McCloud (1974) observed that in the high-yielding Florunner cultivar, flowering did not continue throughout the growing season but lasted for only about 60 days.

Dixie Runner and Florunner peanuts have nearly the same photosynthetic rates and the same crop-growth rates. The major difference between Florunner and Dixie Runner cultivars which results in the increased yield potential is associated with differences in partitioning of daily photosynthate to fruits. The higher-yielding Florunner partitions about 80% of its photosynthate to the pods whereas the lower yielding Dixie Runner partitions only about 40%. Excessive vine growth of Dixie Runner possibly reduces yields due to channeling of energy into vegetative rather than reproductive growth

In 1962, succinic acid-1,1-dimethylhydrazide (hereafter referred to as 'Alar') and now renamed Kylar (succinic acid-2,2-dimethylhydrazide) was reported to be active in modifying vegetative and reproductive behavior in plants (Riddell et al., 1962).

The objective of the research reported here was to test the hypothesis that Kylar suppresses vegetative growth of low-partitioning peanuts (Dixie Runner) which will result in increased partitioning of photosynthate to pods

The following variables were studied application rate, time of chemical application, flower formation, gynophore formation, pod formation, specific leaf weight (SLW), leaf area index (LAI), crop-growth rate (CGR), pod-growth rate, partitioning factor, filling period, final yield, and shelling percentage of Dixie Runner and Florunner peanuts.

LITERATURE REVIEW

Yield Trend in Florida

An analysis of the yield physiology of peanuts is pertinent to the goal of increasing yields. The development of new peanut cultivars by plant breeders at the University of Florida has led to a unique opportunity to study the physiological aspects of yield development. Through the release of four peanut cultivars (Dixie Runner, Early Runner, Florunner, and Early Bunch) the potential yield of peanuts has been more than doubled. These cultivars were developed in the same environment with closely related breeding lines and by standardized methods. Analysis of these cultivars has led to a better understanding of the dynamics of yield for peanuts and legume crops in general.

Peanut yields in Florida have increased remarkably for a legume crop. Yields have increased over four-fold since 1948. This increase has continued with no tendency for leveling off (McCloud, 1976). Much of the yield increase can be attributed to the development of new cultivars.

In 1933, Small White Spanish was crossed with Dixie Giant (a large-seeded Virginia Runner type peanut). From this cross the Dixie Runner cultivar was isolated and purified (Carver and Hull, 1950). The Dixie Runner peanut was released in 1943 and gained wide popularity in Florida and adjacent areas of neighboring states. Carver and Hull (1950) reported that in variety tests conducted in 1946, 1947, 1948, and 1949 Dixie Runner yielded 27% higher than the previously planted common runner peanuts. The most important differences between the two cultivars were the superior seed quality and the superior yielding ability of Dixie Runner. They observed Dixie Runner to mature 10 days earlier than the common runner peanuts, and the branches were more prostrate and compensated for the gaps left by missing hills.

In 1952 the Early Runner peanut cultivar was released. It was selected from the cross made in 1933 between Small White Spanish and Dixie Giant (Carver et al., 1952). It matured about 3 weeks sooner than the common runner peanut. Studies conducted from 1946 through 1951 showed no differences in yielding ability between Dixie Runner and Early Runner. Carver et al. (1952) stated that the principal advantage of Early Runner over Dixie Runner was its shorter growing season, but later studies indicated a yield advantage for Early Runner.

In 1969 the Florunner peanut cultivar was released. The Florunner cultivar quickly replaced Early Runner which had been the most widely grown cultivar in the area. The Florunner cultivar currently is grown on over half the land area devoted to peanuts in the United States and yielded 60% of the total crop output (Hammons, 1976). Florunner was derived from a cross made in 1960 of the cultivars Early Runner and Florispan (Norden et al., 1969). The maturity of Florunner (134 days) at Gainesville, Florida, is approximately 2 days earlier than Early Runner.

The foliage is somewhat less dense in Florunner than Early Bunch, and a greater proportion of the pods is concentrated near the central branch. The seed also matures more uniformly. The average yield for peanuts in Florida had doubled since Florunner's release in 1969. Tests in Florida, Alabama, and Georgia over a 3-year period indicated the yield of Florunner to be greater than that for Early Runner (Norden et al., 1969).

In 1977 the Early Bunch peanut cultivar was released. Early Bunch was derived by pedigree selection from a cross between F406A and F420, two Florida breeding lines (Norden et al., 1977a). Early Bunch matures several to 10 days earlier than Florunner. In yield tests conducted from 1971 through 1976 in Florida, Early Bunch outyielded Florunner by an average of 5% (Norden et al., 1977b). Early Bunch has a spreading bunch growth habit (Norden et al., 1977a).

Physiological Aspects of Peanut Yield and Yield Differences

The determination of crop yield is a complex process, and any review of literature on the subject must of necessity be wide-ranging. To date, literature specific to peanut physiology is neither comprehensive nor extensive. Consequently, appropriate information gained from parallel research into other field crops has been utilized where necessary.

Only recently has an attempt been made to discover the physiological differences between the four cultivars that account for the large increase in yield potential. A better understanding of the physiological differences should aid in future progress in yield improvement. Fisher (1975) stated that yield potential is expressed by grain production under optimal agronomic management and without disease, weeds, or other controllable limitations to the plant. However, when only final yields are determined, little knowledge can be gained concerning how high yields are achieved. Growth analysis is an effective way to study the dynamics of yield physiology.

There are three plausible major explanations for the differences in yields found among different peanut cultivars. Yield can be increased by increasing the partitioning factor, the filling period, or the photosynthetic rate.

In the higher-yielding cultivars, more of the daily production of assimilate may be apportioned to the developing fruit and less to vegetative growth than in the lower-yielding cultivars. This difference in apportioned or distributed photosynthate between the vegetative and reproductive portion of the plant is called the partitioning factor (Duncan et al., 1978). The partitioning factor is different from 'harvest index.' Wallace and Munger (1966) broadly defined the harvest index as the percentage of biological yield represented by economic yield. It generally expresses the percentage of total aerial weight at maturity, not including abscissed leaves, that represents seed weight. Harvest index only reveals what conditions exist at harvest, whereas the partitioning factor reveals the distribution of photosynthate during seed filling.

Gaastra (1962) stated that yields depend upon the total dry matter present at harvest and upon the dry matter distributed among the organs of the plant. Brouwer (1962) questioned whether it is possible to increase the useful output of a crop by influencing the percentage of dry matter in the products to be harvested. However, Van Dobben (1962) noted that the partitioning of dry matter among different parts of the plant is as important as the total yield. He stated that an increase in yield resulting from the use of better varieties may be limited to a shift in the distribution of dry matter to more valuable organs without a reduction in total yield.

Van Dobben was one of the first researchers to bring out the distinction between growth and development. He noted that warm climates (26° C) shorten the period of development without giving sufficient compensation by faster growth. As a result the plants remain smaller than in a cool climate. The overall growth of a plant is dependent on the growth rate of its various organs. Van Dobben (1962) observed that all organs do not react similarly to changes in environmental conditions. There are changes in the ratios of various plant parts (i.e., vegetative vs. reproductive components). Brouwer (1962), Shibles and Weber (1966), and Spiertz (1974) found high correlation between the influence of environmental factors such as temperature, light intensity, soil moisture, and row spacing and the development of various crop plants.

In a personal communication, Dr. K. J. Boote (Associate Professor, University of Florida) reported that, with peanuts, the rate of increase in the dry weight of a single tagged fruit is essentially constant under reasonably uniform growing conditions and temperatures. Egli and Leggett (1976) made similar observations for soybeans. Duncan et al. (1965) reported that the day-to-day weight growth of corn kernels was positively correlated with average air temperature and relatively independent of solar radiation. Koller (1971) found that seed-growth rate in soybean appeared to be controlled primarily by regulatory mechanisms within the seed, rather than by external availability of assimilates. Shibles and Weber (1966) reported that seed yield in soybeans was not correlated with total dry matter produced, dry matter produced during seed formation, or solar radiation intercepted. They noted that seed yield was a function of differential utilization of photosynthate between vegetative and seed production.

Another explanation for the differences in yield among different peanut cultivars would be a longer fruit-filling period for the higher-yielding varieties. Alberda (1962), Brouwer (1962), and Daynard et al. (1971) reported that lengthening the total life of the crop could lead to increased productivity. The longer the crop is able to continue to use sunlight to fix CO_2, the more dry matter the crop can accumulate. Brouwer (1962) concluded that selection for longer vegetative period could be a way of improving yields. However, the period in the life of the crop which should be lengthened is the filling period (Daynard et al., 1971, Egli and Leggett, 1973). The filling period is the time in which the crop is actually partitioning photosynthate into the yield component of the plant. Hanway and Weber (1971b) studied dry matter accumulation in eight soybean varieties. They found that the major differences in the final seed yields resulted primarily from differences in the filling period rather than from differences in the rates of dry matter accumulation. Daynard et al. (1971) noted similar results in corn. They observed a significant linear relationship between grain yield and effective filling period duration. Effective filling-period duration was defined as final grain yield divided by the average rate of grain formation and, hence, is a relative measure of the length of the grain-filling period.

In 1977, 22 of the highest-yielding peanut cultivars from 11 different countries were analyzed. The objective was to determine if they had similar physiological characteristics to the high-yielding Florida cultivars. The harvest date, which was used as an indication of the length of the filling period, was positively correlated with yield. The study also indicated that yield in some of the cultivars may be increased by increasing the filling period and/or partitioning factor (McGraw, 1979).

The filling period appears to be affected by the environment. Egli and Leggett (1973) and Egli et al. (1978) found differences in the filling period for the same varieties over different growing seasons. Low temperatures were associated with low seed-growth rates, a longer filling period, and larger seed for soybeans. Sofield et al. (1974) found that in wheat, higher temperatures increased the rate of growth per kernel but decreased yield due to a decrease in the filling period. In corn, Peaslee et al. (1971) found that nutrition influenced the rates at which corn plants developed through certain states and that the changes in these rates of development were associated with differences in corn yields.

The filling period can also be modified by changing the seed-growth rate. If seed size remains constant, then decreasing the seed-fill rate would require a longer filling period to completely fill the seed. Egli et al. (1978) observed that longer effective filling periods were associated with lower temperatures during the filling period and low seed-growth rates in soybeans.

The third plausible explanation for the difference in yield among peanut cultivars may be a difference in the total photosynthetic efficiency of the crop canopies. A cultivar with a more efficient canopy would produce more photosynthate with a given amount of radiation and would be capable of producing a higher yield. Bhagsari and Brown (1976) measured photosynthetic rates of attached leaves of 31 peanut genotypes, including six wild *Arachis* sp. The photosynthetic rates of genotypes of *Arachis hypogaea* L. ranged from 24 to 37 mg CO_2 $dm^{-2}hr^{-1}$. Florunner had consistently higher rates than most other peanut genotypes. Pallas and Samish (1974) measured the net photosynthetic rates of nine cultivated peanut genotypes and found significant differences in photosynthetic rates at similar light intensities. Trachtenberg and McCloud (1976) measured the photosynthetic rates of Florunner, Early Bunch, and Dixie Runner. They observed no significant differences in photosynthetic rates between the high- and low-yielding varieties. McGraw (1979), in a cultivar experiment with Dixie Runner, Early Runner, Florunner, and Early Bunch, stated that there was no evidence to indicate that an increase in photosynthetic rate was responsible for the increased yields of the newer cultivars.

Shading will reduce the amount of solar radiation reaching the plants. Earley et al. (1967) reported that shading corn for 21 days during the reproductive phase was more detrimental to grain production per plant than shading for longer periods during vegetative and maturation phases. Plants shaded at 60% or higher during the reproductive phase had a full complement of normal leaves but initiated and developed only a limited number of kernels. Prine (1977) found that shading soybeans for as little as 5 or 7 days could reduce the seed yield over 15% compared to the unshaded check. In peanuts, Hudgens and McCloud (1975) reported that the peak flowering period was the period most sensitive to a reduction in solar radiation intensity. An and McCloud (1976) in a similar experiment on peanuts observed that shading during the pod-filling and maturity stages only slightly decreased the number and dry weight of mature pods. Shading was also found to decrease SLW and percent N and starch and to increase canopy deterioration at the end of the filling period (McGraw, 1979). McGraw (1979) found that the shaded Florunner plants yielded 76% of the unshaded control despite the 75% shades over the last 42 days of the filling period. He stated that the greater canopy deterioration, loss of N and starch from the leaves, and relatively high pod yield of the shaded treatment indicated that the pods may have priority for assimilates and nutrients being produced and already stored in the vegetative portion.

Bowes et al. (1972) grew soybeans at different light intensities They found that higher light intensities during growth resulted in increased photosynthetic rates and a higher SLW. Dornhoff and Shibles (1970) noted a correlation between SLW and photosynthesis and suggested that this parameter may be a useful index for the selection of soybeans with high photosynthetic rates

Specific leaf weight may be related to the rate of translocation from the leaf Egli et al (1976) studied soybeans by varying the source-sink ratios. They reported that removal of 50% of the pods increased the SLW of the leaves The pod-removal treatment had a greater percentage of ^{14}C in the leaf than the control They state that the primary effect of altering the source sink ratio was on the movement of ^{14}C labeled assimilate out of the leaf.

Reduction in the SLW in the field may have been the result of more than shading or increased translocation out of the leaf. Tukey (1971) reported that up to 6% of the dry-weight equivalent could be leached from young bean leaves during 24 hours, mainly in the form of carbohydrates

Plant Reproductive Characteristics

An intensive study of reproductive efficiency in *Arachis hypogaea* was reported by Smith (1954). Flowering in the Virginia Runner type roughly followed a normal frequency distribution from about June 30 to frost (at Raleigh, N.C.). Daily removal of flowers until August 18 resulted in a greater number of flowers for the season, with a striking increase between August 18 and September 8. Of particular interest was Smith's finding that of each 100 ovules produced by a peanut plant, only 11.2 produced seed. Flower frequencies displayed cyclic fluctuations over periods of 2 to 5 days. When fruits developed, flowering decreased, but when fruits were removed flowering increased. These findings indicated a flexibility in the reproductive efficiency of peanut plants.

The production of reproductive structures and the factors which determine the quantity and the rate at which they are produced, form a complex but vital part of the yield-determining processes of peanuts. The following stages are evident

A. Flower initiation and production.

B. Peg initiation and elongation.

C. Pod initiation

D. Seed number determination

Flower Formation

Flowering in peanuts is usually described in the literature as having a seasonal frequency curve similar to a normal frequency distribution (Bolhuis, 1959, Goldin and Har-Tzook, 1966, Smith, 1954). Flowering begins approximately 5 weeks after planting and may continue until the end of the growing season. Smith (1954) stated that flowering did not come to an end until the plants were killed by frost in the cultivars he studied. However, McCloud (1974) observed that in the high-yielding Florunner cultivar, flowering did not continue throughout the growing season but lasted for only about 60 days.

Flower production by the peanut usually occurs at a rate and in numbers well in excess of the production of the subsequent structures. Cahaner and Ashri (1974) noted that peanut plants are characterized by indeterminate growth and continuous flowering. Flowering has been found to vary both in duration and rate by numerous authors, and many of the factors which control this process have been examined (Bolhuis, 1958; Bolhuis and DeGroot, 1959; Fortanier, 1957; DeBeer, 1963; Nicholaides, Cox, and Emery, 1969; and Williams, 1975). This considerable research interest in flowering and its control was based on the hypothesis that more flowers or greater efficiency of the flower, would result in higher yields through the production of more pods.

Both environmental and internal factors influence flowering. Both of these influences apparently operate largely by influencing the photosynthetic material available.

The daily rate of flowering is influenced by the photosynthesis 2 to 3 days previously, temperature being an aspect of the environment that has a major role in determining the rate of flowering (Nicholaides et al., 1969). Fortanier (1957) found that flowering was well related to mean temperature, provided the range did not exceed 20° C. Wood (1968) also noted a highly significant correlation between flower production and a heat unit value. Wood attributed this relationship to the influence of temperature on net assimilation rate (NAR) and suggested that the [illegible] by the availability of photosynthate

This conclusion is also supported by the results of Bolhuis and DeGroot (1959) and DeBeer (1963) who, when studying the influence of temperature on flower production and growth, found that most flowers were produced at the temperature which was optimum for the vegetative growth of a particular variety

Bolhuis and DeGroot (1959) and DeBeer (1963) found that in growth chambers, varieties had different flowering rates and duration, a result repeated for a different set of varieties grown under field conditions (Williams, 1975) These varieties had different rates of flower production, despite similar overall growth rates, which indicated the importance of genetic factors other than photosynthesis in controlling flower production

The duration of flowering is influenced by the development of the reproductive sink which reduces the amount of photosynthate available for flowering Flowering appears to cease at some internal level of assimilate availability (Hudgens and McCloud, 1975) Furthermore, the removal of pods has been found to stimulate flower production (Smith, 1954, and Bolhuis, 1958)

In addition to the photosynthate supply and genetic controls on flowering, another unidentified internal factor may influence flower production, as hypothesized by Nicholaides et al (1969)

Peg Initiation and Elongation

Not all flowers result in pegs, and the factors which influence this process also have a powerful influence on the determination of yield

From the literature available, it would appear that the success of flowers in producing pegs is influenced by the same factors that influence flowering. However, not a great deal of attention appears to have been paid to this aspect of the reproductive process. Har-Tzook and Goldin (1967) have reported that approximately 55% of flowers did not develop pegs.

Williams et al. (1975a) found that the rate and duration of pegs produced from crops grown at three altitudes varied considerably. Cool temperatures slowed the rate of peg initiation while in warmer conditions the duration was increased relatively to that recorded at intermediate temperatures. The patterns followed quite closely the vegetative growth rate and duration. Williams et al. (1976) also found that time of initiation of pegs was altered by varying the source-sink ratios. Any treatment which increased the photosynthate availability also enhanced pegging and vice versa. There are considerable differences in peg production rates despite similar growth rates and apparent assimilate status (Williams et al., 1975b).

De Beer (1963) studied the influence of temperature on flowering efficiency, and reported that the low flower-to-peg efficiencies reported at temperatures above 33° C were due to pollen becoming non-viable at those temperatures. Under normal conditions, however, the pollination percentage was found to be 25% (Smith, 1954); hence, pollination as a cause of low efficiency at temperatures below 33° C was precluded.

The interpretation of data concerning the development of pegs is considerably complicated because flowering efficiency may be initially very high and decreases as development progresses (Martin and Bilquez, 1962). This effect was not apparent when one considers the relative rates of flowering and pegging for range of varieties in Rhodesia (Williams, 1975).

Humidity has also been found to influence the flower-to-peg success ratio (Lee, Ketring, and Powell, 1972). However, how much of this is due to water stress as opposed to a pure humidity effect is not clear, as no report was made of the plant-water potential at high and low humidities.

The elongation of pegs may be an important aspect of the development of the reproductive sink. The peg to pod ratio was found to decrease with increased stem mass (Williams et al., 1975a). The pegs may be unable to reach the soil when high temperatures have increased stem growth markedly. This problem would probably be most important in the Bunch types with upright habit, where stem growth greatly increases the distance between the nodes and soil. Although no information is available for a comparison of pegging success between upright and prostrate plant habits, Williams (1978) reported that pegs may grow up to 30 cm. However, there is no critical evidence on the maximum possible length attainable.

As previously stated, little information is available on the factors which influence the elongation rate of the pegs. Lee et al. (1972) reported that the relative humidity could substantially affect the rate of elongation. The effect was markedly influenced by the stage of reproductive development. The first pegs were apparently uninfluenced by the relative humidity, while later pegs had slower growth rates when the relative humidity was 50% as opposed to 25%. Their conclusion, however, appears suspect as stages of development and treatment effects have been to a great extent statistically confounded. No treatments were maintained at high or low humidity for the full duration of this study.

Pod Initiation

Peanut plants produce many more flowers than mature pods (Bolhuis, 1958; Smith, 1954; McCloud, 1974). The efficiency of peanuts is generally 10 and 20% of the flowers producing mature pods (Cahaner and Ashri, 1974, Goldin and Har-Tzook, 1967, Smith, 1954). The pods that develop come primarily from the first flowers (Cahaner and Ashri, 1974, Har-Tzook and Goldin, 1967, Shear and Miller, 1955). Of the pegs that are produced, many do not develop into mature pods (Har-Tzook and Goldin, 1967, Shear and Miller, 1955). Shear and Miller (1955) determined that only 15% of the pegs formed pods in the plants they studied. The first pegs produced the most pods. A large portion of the pods that are formed do not reach full maturity (Har-Tzook and Goldin, 1967, Smith, 1954). Har-Tzook and Goldin found that only about two-thirds of the total number of pods produced reach full maturity.

As with flower and peg production, the initiation of pods depends on internal factors, as well as the production of pegs and the entry of these into the soil. Although some research has been done into the biochemical control of pod initiation, it is clear that no practical replacement for peg burial exists, as the process requires dark, moist conditions (Shenk, 1961).

The rate of initiation of pods and the duration for which they are initiated from pegs has been found to vary substantially with the supply of photosynthate (Hudgens and McCloud, 1975, Williams et al., 1976) and with varieties (Duncan et al., 1977; Williams et al., 1975b).

Fortanier (195[illegible]) reported that high temperatures influence the production of pods from pegs. This influence was attributed by DeBeer (1963) to the effect of temperature on the germination of pollen. There is some doubt of the validity of this conclusion, however, as pegs did develop and there is no evidence that pegs develop without the fertilization of the ovules. Some other aspect of the reproductive physiology may be responsible for the failure of pegs to develop under these conditions.

Increased daylength was found by Fortanier (1967) to have no effect on the reproductive processes of peanuts, other than that which may be attributed to variation of photosynthate supply. However, Wynne, Emery, and Downs (1973) claimed that short days favor fruit initiation from pegs. The data presented and the methods utilized do not, however, provide sufficient evidence to identify this positively as a day-length effect. Plants under long-day treatment had 20% more mass and 58% greater plant height, at the termination of this experiment 70 days after sowing. It is not improbable that the reduced peg efficiency may have been the result of the brief time allowed for the pegs to reach the ground from the greater height attained by the long-day plants.

Water stress is known to have a significant effect on the pod-setting process (Fourrier and Prevot, 1958). Although no information was presented by Fourrier and Prevot (1958) with respect to peg production, yield and pod numbers were shown to be decreased by water stress. These effects are consistent with the effect of photosynthate availability on reproductive processes and water stress influence on photosynthetic rates.

Seed Number Determination

Very little of physiological significance has been recorded concerning the control of the number of seeds developed in each pod. Williams (1975) found a trend for numbers of seed per fruit to increase with temperature, while the differences in yield between cultivars Valencia R1 and Natal Common could be attributed largely to the greater number of seeds per pod in Valencia peanuts (Williams et al., 1975b).

The genetic control of number of seeds per pod has been well established, as this characteristic has been used to aid the botanical classification of peanuts (Gibbons, Hunting, and Smartt, 1972).

The importance of mineral nutrition with respect to the development of seeds within a pod has been well documented, because this facet of the crop received early agronomic attention in order to identify and overcome the effects of deficiencies which cause the failure of seeds to develop within pods (Harris and Brolmann, 1966a and 1966b).

Kylar

In 1962, Riddell et al. reported plant growth regulating activity in N-dimethylaminomaleamic acid (CO-11) and its succinic acid analogue, Kylar. CO-11 was applied to seedlings of several plant species as a 5,000 ppm foliar spray. At 1 month following spray application, the treated peanuts (Arachis hypogaea L.) were 50% as tall as the controls. The effect was primarily on internode length. One month after treatment with Kylar at 1,000 ppm, the average internode length for treated pinto bean plants (Phaseolus sp.) was 2.5 cm, compared to 6 cm for untreated controls.

Bukovac (1964) treated Blue Lake bean plants with various concentrations of CO-11. Plant height was reduced in proportion to concentrations over a range of 10 to 4,000 ppm. The treated plants bore darker green foliage, and internodes were shorter and thicker At high concentration, a slight reduction in leaflet expansion and dry matter accumulation appeared The number of nodes per plant was unaffected Flowering was delayed slightly by 4,000 ppm of the inhibitor. The inhibitor effects were reversed by application of gibberellin A_3 at 10 or 100 ppm. Bukovac proposed that the inhibitor might act by interference with the natural synthesis of gibberellin in the plant.

Marth (1963) applied CO-11 to holly (*Ilex* sp) at 150 mg per plant as a soil drench and noted very little plant response.

Following the reports of Riddell et al (1962), Marth (1963), and Bukovac (1964), research interest was concentrated on the more active analogue, Kylar Numerous references point to reduction in plant height following Kylar application Stuart (1962) reported height reduction in azalea with Kylar Restricted shoot elongation in grape (*Vitis labrusca* L) was reported by Bukovac et al (1964) Jaffe and Isenberg (1965) found that Kylar sprays retarded growth of tomato (*Lycopersicon esculentum* L.) and petunia (*Petunia* sp) seedlings in proportion to concentration Edgerton and Hoffman (1965) showed that Kylar reduced terminal-shoot growth to 40% of controls in apple (*Pyrus malus* Focke). Halevy (1963) showed reduction in terminal growth of cucumber (*Cucurbita* sp), and Reed et al (1965) reported height reduction in peas (*Pisum sativum* L)

Several workers have noted effects of Kylar on flowering and fruiting. Batjer et al (1964) applied Kylar to apples, pears (*Pyrus* sp) and sweet cherries (Pruniss sp) beginning 15 to 17 days after full bloom. Shoot growth was reduced and a marked increase in bloom was observed the spring following treatment Blossoming was delayed and fruit size was reduced in apples. Maturity of sweet cherries was advanced Greenhalgh (1967) studied the effect of Kylar on flower-bud initiation in apple. Significant increases in bloom initiation were obtained on three cultivars. The increases were related to Kylar concentrations and to degree of shoot-growth retardation. Stuart (1962) increased both the site and number of flowers in azalea with applications of Kylar.

Various effects of Kylar on leaves have been reported. Batjer et al (1964) noted larger leaves in apple trees treated 2 weeks after full bloom Edgerton and Hoffmann (1965) found that leaves from apple trees treated with Kylar were normal in shape but often larger than those of controls The treated leaves were also darker green and thicker than leaves of controls Crittendon (1966) reported that Kylar induced reduction in the leaf area of ornamental chrysanthemum (Chrysan sp.) and poinsettia (Poinsettia sp.) Jaffe and Isenberg (1965) found no correlation between Kylar concentration and total leaf area

Relating to observation of darker green color in treated leaves, studies on the effects of Kylar on chlorophyll concentration have been made. Crittenden (1966) found increased chlorophyll per unit of fresh leaf area in Kylar-treated leaves. He attributed this phenomenon to reduction in total leaf area, since no increase in chlorophyll on the leaves of fresh weight was observed An increase was noted in the density of palisade cells in treated leaves.

Kylar appears to influence the uptake of certain mineral nutrients. Bukovac (1964) found that K concentration in leaves of treated plants was less than that of controls. Calcium, Mn, Cu, and B concentrations were increased by the treatment. Levels of N, P, Fe, and Zn were not altered. No change in any element was reported in stem tissue. However, the ratio of an element present in stems to the element present in leaves was higher in the Kylar treatment for nine of the ten elements tested. Crittendon (1966) found that levels of foliar Fe, Cu, Zn, Na, Ac, Sr, Mo, and Co were unaffected by Kylar in chrysanthemums. Levels of P, Se, and B were increased, while levels of Ca and Mg were decreased by the treatment. In poinsettias, levels of N and P were higher in treated leaves while levels of K, Se, and Mn were lower.

A number of post-harvest effects of Kylar have been reported. Williams et al. (1964) found that Kylar, applied to apple trees 2 to 5 weeks after full bloom, inhibited the development of scald in storage. Shelf-life of the fruit after removal from storage was extended by the inhibitor. Edgerton and Hoffman (1965) noted that Kylar applied to apple trees following 2,4,5-T, offset the effect of the auxin in softening fruit. Larsen and Scholes (1965) treated cut carnations with Kylar combined with 8-hydroxyquinoline and sucrose. The treatments more than doubled vase-life and increased flower diameter.

Jaffe and Isenberg (1965) found that Kylar treated cucumber plants were more resistant to freezing. These workers also observed that plants treated with 5,000 ppm Kylar and grown at 16 to 21° C developed the same growth curve as untreated plants grown at 10 to 16° C. Marth (1965) treated cabbage plants (*Brassica* sp.) in October with Kylar at

625 to 5,000 ppm. These were planted outdoors at Beltsville, Maryland, and grown until May. The survival of controls was only 40%, while 100% of the Kylar-treated plants survived. She found that plants treated with 625 ppm Kylar bolted during the spring following treatment, whereas plants treated with 2,500 ppm produced no flower stalks. Edgerton and Hoffmann (1965) reported that prebloom application of Kylar to apple trees delayed bloom 1 to 3 days. Greater fruit set occurred when frost followed treatment with Kylar. Martin and Lopushinsky (1966) measured some effects of Kylar on plant-water relations. The inhibitor reduced transpiration slightly but had little effect on the total water deficit of plants under environmental stress. Onset of wilting was not delayed by the treatment, but treated plants recovered from wilting more readily than controls.

Crosson and Fieldhouse (1964) reported an interaction of Kylar with a plant pathogen. Six applications of the chemical were applied to pepper plants (Capsicum sp.) at weekly intervals beginning June 27. Kylar caused a significant reduction in leaf drop and in percentage of fruit infested by bacterial spot.

Kylar has been shown to behave systemically in plants. Riddell et al. (1962) found that spraying only primary leaves of bean resulted in subsequent inhibition of internode elongation. Movement and rate of Kylar were reported by Martin et al. (1964). Kylar labeled with ^{14}C in the center two carbon atoms was used for tracing. The chemical was applied to roots, excised stems and petioles. Movement was rapid and dispersed from either point of application, following estimated flow rates for the transpiration stream. Kylar was not applied to a leaf to evaluate phloem transport.

Chromatographs of extracts from treated plants showed that 37% of the labeled Kylar remained intact after 24 hours in the plant. After 120 days, 79% of the labeled materials remained intact, thereby indicating a slow breakdown.

Martin and Williams (1966) applied diamazine and succinc acid-labeled Kylar to apple trees through roots and by injection into the trunk. Similar decomposition rates were found for both labels. Both labels moved freely throughout the plants and from the roots to the soil. That the chemical did not accumulate in the soil indicated rapid decomposition. Degradation occurred continuously throughout the growing season. Incorporation of the label into polysaccharides was negligible even though a constant evolution of $^{14}CO_2$ occurred.

A chemical that affects stem elongation in the manner reported for Kylar might be expected to interact with other plant growth regulators. The relationship of auxins and gibberellins to Kylar has attracted the attention of several workers. Halevy (1963) treated cucumber seedlings with Alar at $3x10^{-3}M$ and measured resultant IAA oxidase activity in plant extracts. In the hypocotyls and cotyledons, IAA oxidase activity was significantly increased by the treatment. No such increase was noted in extracts of radicals. Interestingly, growth of the radicals was not inhibited. Halevy concluded that Kylar exerted its effect on plant growth by affecting the auxin level of the tissue through IAA oxidase activity. Abeles and Rubenstein (1964) reported that Kylar inhibited ethylene evolution. They suggested that ethylene production was regulated by auxin, and that auxin levels were modified by Kylar.

Kuraishi and Muir (1963) examined the interaction of auxin with CCC (2-chloroethyltrimethyl-ammoniumchloride), a compound which induces plant responses similar to that of Kylar. They found that inhibition by CCC could be reversed by indoleacetic acid. Also, diffusible auxin stem apices of peas retarded with CCC was only one-seventh the level of normal plants.

Paleg et al. (1965) found that Kylar did not retard release of reducing sugars, caused by gibberellic acid from barley endosperm. These authors suggested that Kylar be termed a "growth retardant," not an "antigibberellin," since any effect on gibberellin was through biosynthesis. Murashige (1965) failed to reverse gibberellin-induced growth in tobacco callus with Kylar. This lack of interaction was thought to rule out negative effects of the retardant on gibberellin biosynthesis. It was speculated that the biochemical system for such competition was lacking in tobacco callus in vitro. Sachs and Wahlers (1964) found that inhibition by CCC and Phosphon in carrot callus could not be reversed by either gibberellin or auxin.

Reed (1965) proposed that BOH (β-hydroxyethylhydrazine)-induced flowering of pineapple plants by reducing auxin concentration. This retardant ($3.3x10^{-7}M$) specifically and almost completely inhibited the oxidation of tryptamine to indoleacetaldehyde in pea-seedling extracts. Furthermore, Reed found that oxidation of putrescine to pyrroline was also inhibited by BOH. He concluded that diamine oxidase activity must have been induced. Based on the BOH work, Reed et al. (1965) suggested that Kylar might also inhibit oxidation of tryptamine diamineoxidase. These workers treated both tall and dwarf peas and found that inhibition was in direct proportion to the relative rate of elongation in each variety of pea. Dry weight of shoots was not affected by any Kylar treatment. Extracts of treated and control plants were used to test oxidation of tryptamine-2-^{14}C to indoleacetic aldehyde-2-^{14}C. Extracts of Kylar treated plants caused a marked inhibition of the oxidation. This was attributed to inhibition of diamine oxidase. Also pea epicotyl homogenates treated with dimethylhydrazine at 3.3×10^{-7}M caused 50% inhibition of tryptamine oxidation. It was concluded that hydrolysis of less than 0.1% of the administrated Kylar to dimethylhydrazine could account for the inhibition observed.

Response of Peanuts to Kylar

Peanut (*Arachis hypogaea* L.) may exhibit an indeterminate growth habit with flowering beginning approximately 4 to 5 weeks after planting and extending to harvest or the first killing frost. This and other growth characteristics present several problems in the culture and management of this crop. The excessive vine growth, especially in warm humid climates, makes foliage disease control and harvesting difficult. Because the fruit of the peanut develops underground, the crop is subject to heavy harvesting losses resulting from the breakage or disintegration of the peg (*gynophore*) that attaches the fruit to the plant. Losses are increased by excessively dry or wet weather at harvest time or by other factors that may delay harvesting beyond the time when the fruit has reached maturity. Loss in yield may also be due to nutrients being utilized for vegetative rather than reproductive growth (Baumann and Norden, 1971a).

Because of these problems, the experimental use of the growth regulator Kylar (succinic acid-2,2-dimethylhydrazide) has received considerable attention on peanuts in the temperate United States (Brittain, 1967). Brittain (1967) studied the response of peanuts to Alar renamed Kylar (succinic acid-2,2-dimethylhydrazide). This study was based on the hypothesis that Kylar would increase fruit production in peanut plants. He reported that peanuts densely spaced (45-cm rows) and treated with Kylar produced greater yields of fruit than untreated plants at the same spacing. Laboratory experiments were conducted in an effort to find physiological causes for the observed effect of Kylar on peanut yields. He found that stems of Kylar-treated plants were shorter than those of controls, and internodes of treated plants contained cells which were shorter and of greater diameter than those in untreated plants. Brittain (1967) reported that the concentration of Ca in stems of plants treated with Kylar exceeded that of untreated plants, and the levels of RNA in cotyledons of germinating peanut seeds were increased by Kylar. Brittain (1967) treated pea internode sections with Kylar for 8 hours before addition to auxin. This treatment resulted in 50% inhibition of auxin-induced growth. He suggested that the increase in RNA reported may relate to increased synthesis of an enzyme such as IAA oxidase. The inhibition by Kylar of auxin-induced growth seems to support this view. Leaves of plants treated with Kylar appeared greener and contained a higher concentration of chlorophyll than controls. Rates of net CO_2 assimilation were increased by Kylar treatment when the plants were densely spaced. These findings suggest that Kylar may directly increase the photosynthetic efficiency of a unit area of canopy (Brittain, 1967).

Chappell and Brittain (1967) reported increased yields for three different varieties when treated with Alar. They also noted a reduction in percent fancy pod and an increase in extra large seeds and sound mature seeds in Kylar treatments. Hodges and Perry (1970) obtained a significant yield increase for 'Florigiant' but not for NC-2 when treated with Kylar. They also noted lower pod loss at harvest in the Kylar-treated plots and postulated that increased yields could be due to better pod retention.

Baumann and Norden (1971a) applied Kylar and TIBA to three varieties and three experimental lines of peanuts and noted a reduction in cotyledonary lateral branch length for the growth regulators. This response varied with the genotype of the peanuts. Both Kylar and TIBA produced a darker green foliage, but no significant effects on peg strength. Perry (1972) noted similar dark greening of peanut plants when treated with Kylar, just as the plants normally begin to lose some of their lush green color. He postulated that the color effect is apparently caused by an increase in chlorophyll, which could make the plant more efficient in intercepting and using the sun's energy. Along with this color the leaves become noticeably thicker.

Brown and Ethredge (1974) noted a consistent reduction in vine growth with Kylar, which was due to shorter internodes. When Kylar was applied 60 days after planting, yield increases ranged from 0 to 8% with an average of 5%. In other tests they obtained responses ranging from a 6.3% reduction to 20% increase in yields on Florunner. They also noted that Kylar applied 6 weeks after planting can reduce length and weight of nuts, as well as length of pegs. Based on their studies, the optimum time for applying Kylar was 6 to 8 weeks after planting. Brown et al. (1973) reported increased yields due to Kylar application in 1968, but not in 1969 or 1970. The increase in yield in 1968 was similar for irrigated and non-irrigated peanuts. The most consistent effect of Kylar was a reduction of plant height. Stem lengths were reduced 30 to 40% by Kylar application. Pod length was reduced by 6 to 10% in 1969 and 4% in 1970 when plants were treated with Kylar. Peg length in 1970 was 2.7 cm on Kylar-treated plants compared to 3.4 cm for controls. No consistent effect of Kylar was noted on stem weight per plant, specific leaf area and area of leaflets. Dry weight per leaflet was not affected. They concluded that the reduction of top growth may be beneficial because ground machinery can be used later than usual in the season to apply insecticides and fungicides without damage to the peanut plants.

Brown and Ethredge (1974) reported that the pod yield of all cultivars was increased by Kylar in 1970 by an average of 20%. Yields in Spanish-type cultivars were increased in 1971 but not in 1972, while yields of runner and Virginia cultivars were not affected in 1971 nor 1972. There was a trend for increases in the number of pods per plant in Spanish cultivars in all 3 years and in runner and Virginia types in 1970. Weight per 100 pods was reduced in the Spanish cultivars only in 1972.

Morris (1970) applied three growth regulators to Spanish peanuts at different plant populations. Yields were decreased by Kylar and increased by TIBA and Chloro-IPC (isopropyl N-(3-chlorophenyl) carbomate). The number of seeds was increased by all three chemicals.

Perry and Hodges (1974) studied the effect of Kylar on yield, grade factors, and germination of Florigiant peanuts. They found no consistent effect on pod yield at two locations while yields were depressed with all treatments at the third location. The effects on sound mature seeds, extra large seeds, and fancy seeds were inconsistent between locations, but tended to decrease slightly as the rate was decreased. They found no effects on field emergence, but found differences in germination and dormant seed percentage where the 225 and 450 g/ha rates were used. Bockelee-Morvan et al. (1975) reported considerable yield increases by Kylar on 28-206 (Virginia type) and 47-10 (Spanish type) in Mali, and GH-119-20 (Virginia commercial type) in Senegal. They noted that Kylar significantly improved yield quality especially the percent of seed germination. The germinative value was increased from 85 to 87% of viable embryos for the 28-206 Virginia cultivar and from 90 to 93% for the 47-10 Spanish cultivar. They stated that the number of flowers was not affected, but there were increases in the numbers of pegs and pods which led to yield improvement.

Gorbet and Whitty (1973) applied Kylar and TIBA to peanuts in several field experiments over 3-year period. Rates of various chemicals, peanut varieties, dates of harvest, irrigation schedules, and other factors such as yield and quality, vegetative growth, plant-water relationships, and varietal response to chemicals were varied in the studies. None of the chemicals consistently affected yields. However, when conditions were favorable for vegetative growth, Kylar increased yields. Both Kylar and TIBA retarded vine growth especially when soil moisture was adequate. They also noted that Kylar caused the vines to be darker green than normal. They also indicated that genotype and planting date could affect yield response to Kylar. In general, irrigation combined with Kylar increased yields They postulated that growth regulator must be used under certain environmental conditions for greatest effectiveness

Gorbet and Rhoads (1975) conducted a similar experiment with Kylar on Florigiant and Florunner They found that the total pod production of both cultivars was increased with irrigation, especially in dry seasons They concluded that the growth regulator, Kylar, and irrigation resulted in the greatest peanut yields when averaged across years (52 and 56 g/ha for Florigiant and Florunner, respectively)

MATERIALS AND METHODS

Description of the Chemical

In early reports, succinic acid-1,1-dimethylhydrazide was called "B-995" (succinic acid-2,2-dimethylhydrazide is synonymous with n-dimethylaminosuccinamic acid). This name was the first assigned to the substance and is frequently seen in the literature). The structure of this chemical is shown in Fig. 1.

In some references, the term "B-Nine" appears. This is the trade name of the manufacturer, Uniroyal, Inc., for a 5% liquid formulation of the chemical. Alar-85, Kylar-85, and B-Nine-SP are the trade names of Uniroyal, Inc., for its 85% soluble powder formulation (Table 1). Its common name is Daminozide. For convenience, the term "Kylar" is used throughout this dissertation when reference is made to succinic acid-2,2-dimethylhydrazide.

General Information

Kylar-85 is a water soluble growth regulant for peanuts. The manufacturer claimed and reported that when the solution is sprayed on plants, the chemical moves into the leaves, then moves freely inside the plant. Since 6 hours may be required for the chemical to move inside the plant, application should be delayed if rain is expected within 6 hours. Peanut vines are shorter, more erect, greener in color, and yields are usually increased as a result of Kylar-85 treatment (Anonymous, 1977).

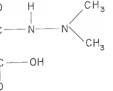

Fig. 1. Chemical formula structure of succinic acid-2,2-dimethylhydrazide.

Table [illegible]. The Composition of Kylar-85.

Composition	
Active Ingredient (% by weight)	
Daminozide (succinic acid 2, 2-dimethylhydrazide)**	85%
Inert Ingredients	15%
TOTAL	100%

** U.S. Patent Nos. 3, 240, 799-3, 334, and 991.

Kylar-85 can be applied from the time peanut plants are at least 30 cm across until 30 days before harvest. An application of 1 kg per ha in a minimum of 40 liters of water by ground sprayer, or 20 liters of water by aerial sprayer when peanut plants are 30 to 60 cm across is recommended to encourage fruiting closer to the tap root. This timing or a later application just before "lapping" also suppresses vine growth, improves yields, and makes harvesting easier (Anonymous, 1979).

Kylar-85 functions best when plants are actively growing. Manufacturer reports that applications should not be made when plants are wilted from drought stress. The best results can be expected from morning applications.

Description of Field Studies

The first year's research was conducted at the agronomy farm of the University of Florida during the 1979 growing season. The soil was a Jonesville taxajunct, now classified as loamy, mixed, thermic Arenic Hapludalf. The soil analysis data are given in Table 2. The experimental site was broadcast fertilized with 550 kg/ha of 2-10-10 fertilizer turned and disked. One week before planting, 7 liters of benefin and 2.3 liters of Vernolate/ha were applied. Seven liters of alachlor and 14 liters of dinoseb were also applied at cracking (emergence) to control weeds. To control disease and pests during the growing season, 1.5 kg of chlorothalonil and 1.5 kg of carbonyl/ha were applied at 15-day intervals beginning at flowering. Gypsum was applied at a rate of 670 kg/ha at pegging. The fertilizers, herbicides, and fungicides applied were at recommended levels for maximum yield.

The seeds were hand planted on 12 and 13 June at a nearly equidistant spacing of 30 x 26 cm. This spacing resulted in 12.9 plants/m^2 which is within the ranges of maximum yield for Florunner peanuts, one seed was placed at each planting point and after emergence transplanting insured a uniform stand. Overhead irrigation was applied at planting to encourage uniform germination and during periods of low rainfall to insure adequate soil moisture.

Two peanut cultivars (Dixie Runner and Florunner) were planted. Dixie Runner peanut was released in 1948 by the University of Florida. Dixie Runner is a low yielding peanut which partitions 40% of its assimilate to pods. Florunner, released in 1969, is an improved higher yielding peanut cultivar, which partitions 80% of its assimilate to pods (Duncan et al., 1978).

Kylar (Fig. 1) was used to suppress the vegetative growth of both Dixie Runner and Florunner peanuts. Kylar at 1.7 kg/ha was applied in split applications. Kylar was first applied at 1.1 kg/ha and 2 weeks later at 0.6 kg/ha.

Six dates of Kylar application were selected as follows: 30, 44, 58, 72, 86, and 100 days after planting (Table 2). Each application time corresponded to one treatment, so that there were six treated plots and one control per cultivar. The following treatments were used

Dixie Runner		Florunner	
DR_C	DR_{72}	FR_C	FR_{72}
DR_{30}	DR_{86}	FR_{30}	FR_{86}
DR_{44}	DR_{100}	FR_{44}	FR_{100}
DR_{58}		FR_{58}	

Table [illegible]. Schedule of Kylar application, treatments, and the corresponding plant development in 1978

Treatments	Date	Plant age	Plant development
		days	
C	Control		
30	July 17-July 31	30-44	Flowering
44	July 31-Aug 14	44-58	Pegging
58	Aug. 14	58-72	Pod setting
72	Aug. 28	72-86	Seed development
86	Sept. 11	86-100	Pod filling
100	Sept 25	100-114	Maturing

Table 3 Schedule of Kylar application, treatments, and the corresponding plant development in 1979

Treatments	Date	Plant age	Plant development
		days	
C	Control		
45	June 11-Aug 20	45-115	Flowering to maturing
87	July 23-Aug 20	87-115	Pod filling to maturing

The experiment was planted in a complete randomized block design with four replications. Each block was divided into subplots consisting of seven rows of 60 plants each. Five rows of five plants (25 plants) were used in each sample. One border row was between each subplot and two border rows were between varieties. Samples were taken from each subplot beginning at one end of the field and moving successively across the field.

Application of Kylar

Kylar at the rate of 1.7 kg/ha was applied at 14-day intervals in split applications of 1.1 kg/ha which would encourage fruiting closer to tap root (Uniroyal, Inc., 1978). A second application of 0.6 kg/ha was made 14 days later to suppress vine growth. To avoid water stress, overhead irrigation was applied 2 to 3 days before treatment. Kylar was sprayed early in the morning when the plants were vigorous and active.

A back-pack compression sprayer with four nozzles connected to an 8-liter container was used to spray the solution. A CO_2 bottle was used as a source of pressure. Kylar was dissolved at the concentration of 3.0 g/liter of water and 20 liters/ha of solution under a pressure of 738 Newton/m^2 were applied.

Sampling

Sampling began 16 days after planting and continued at 14-day intervals. As samples were taken on 14-day basis, specific data such as when flowering began or when peak LAI was reached are only approximate. At each sampling 25 plants were pulled by hand early in the morning. No special measures were taken to remove all the roots, however, the soil was coarse textured and it is believed that the

Table 4 The pH, double-acid extractable and exchangeable nutrients, ECEC, total acidity organic matter percentage, and total nitrogen in soil from the 1979 experimental area*

pH		Double-acid extractable nutrients									Exchg elements				Total	Org.	Total
H_2O	KCL	Ca	Mg	P	K	Fe	Mn	Zn	Cu	ECEC	Ca	Mg	H	Al	acidity	matter	H
		ppm								meq/100g soil						%	-ppm-
5.7	4.7	325	44	157.7	68	10.3	7.2	6.34	0.4	3.33	2.40	0.48	0.17	0.28	0.48	1.24	500

* 20-cm soil depth

majority of the root-mass was removed. From each subplot the 25 plants were divided into 21-, 3-, and 1-plant samples. The three- and one-plant samples were selected for uniformity and transported to the laboratory for analysis.

Description of Laboratory Studies

The one-plant samples were used to determine the individual plant characteristics. Numbers of pegs, pods, and flowers were recorded. Both wilted and unwilted flowers were counted. The length of the main stem, the eight longest branches, and the tap root were measured. After separation into stems, leaves, roots, and pods, the plants were dried at 70° C and the dry weight recorded. Before drying, a 100-leaf subsample was removed for calculation of the LAI. The leaf area of this sample was measured on a Hayashi Danko, Co., Ltd., Automatic Area Meter, Type AAM-5. The dry weight of the subsample was also recorded. The leaf area was determined by calculation of an area per unit weight ratio from the leaf subsample. From the leaf area per plant and the plant population of the crop, the LAI was calculated. After the pods were dried and the dry weight recorded, the seeds were removed with a shelling machine and the dry weight of the seeds recorded.

The three-plant samples were used to determine the pod number and pod weight on a per plant basis. The plants were removed by hand, counted, dried at 70° C, and the dry weight taken.

The twenty-one-plant samples were used to determine the dry weight yields of the vegetative and reproductive plant parts. The plants were dried at 70° C and the total dry weight recorded. After drying, the pods were removed from the vegetative components and pod dry weight taken. The differences between total dry weight and pod dry weight gave the dry weight of the vegetative plant part.

During the 1979 growing season, similar materials and methods to those in 1978 were used. The number of treatments was reduced and the rate of Kylar was increased in an effort to suppress further the vegetative growth of the peanut plants. Both Dixie Runner and Florunner cultivars were divided into three sub-plots (C, 45, 87) each.

C = Control which received no Kylar applications

45 = Kylar applied at the rate of 3.7 kg/ha in split application beginning 45 days after planting and continued at 14-day intervals until day 115

87 = Kylar applied at the rate of 3.7 kg/ha in split application beginning 87 days after planting and continued on 14-day intervals until day 115.

The following treatments were observed:

Dixie Runner	Florunner
DR_C	FR_C
DR_{45}	FR_{45}
DR_{87}	FR_{87}

The experiment was planted in a complete randomized block design with four replications. Each block was divided into seven sub-plots with 59 plants each. Twenty-one plants were used in each sample. Kylar was applied by means of a back-pack compression sprayer with four nozzles using 46.8 liters/ha of water under a pressure of 738 Newton/m^2. The schedule of the periods of Kylar applications is presented in Table 3. Climatic data for the growing season are shown in Fig. 3. The seeds were hand planted on April 27 The plant density and cultural practices were similar to those used in 1978.

Sampling began 31 days after planting and continued at 7-day intervals. From each subplot the 21 plants were divided into 20-, and 1-plant samples. The 1-plant samples were selected for uniformity and transported to the laboratory for analyses. The observations and analysis on both 20-, and 1-plant samples were similar to those used in 1978.

Statistical Analyses

All statistical analyses were performed at the Northwest Regional Data Center of the State University System of Florida. The center is located at the University of Florida, Gainesville. The analyses were produced using the procedures of the Statistical Analysis System (SAS) of the SAS Institute, Inc.

Analysis of variance was performed using SAS's General Linear Models procedure. Correlations were performed using SAS's Correlation procedure. Duncan's Multiple Range Test (MRT) was used for evaluating statistically significant differences among the means of various treatments.

RESULTS AND DISCUSSION

The 1978 and 1979 Experimental Conditions

Weather

The mean air temperature of the 1978 growing season was 26° C (Fig. 2). The first 3 weeks following the planting were characterized by a high mean temperature of 27.5° C with a mean maximum of 33.3° C and a mean minimum of 21.7° C. The mean air temperature in 1979 was 25° C. During the first 3 weeks after planting a mean temperature of 23.4° C with a maximum of 30° C and a minimum of 16.9° C occurred. The mean solar radiation reached 583.4 MJ/m^2 in 1979 as compared to 549.4 MJ/m^2 in 1978, a difference of 33.8 MJ/m^2.

Rainfall was unevenly distributed during the 5-month growing season in 1978. It varied from 6 mm in September to 263 mm in July. Precipitation of 245 mm in August and the last 2 weeks of June, the month of September and the first week in October were deficient with 10, 6, and 12 mm of rain, respectively. Heavy rains occurred during the 1978 growing season. Water stood on portions of the plots for 5 days on July 28th, 3 days on August 2nd, and 5 days on August 11th. These conditions may have influenced the growth and development of the peanut plants. Unfortunately, rain occurred 20 minutes to 2 hours after every Kylar application which probably affected the efficiency of the chemical. In 1979, however, rainfall was well-distributed during the 6-month growing season. It varied from 85 to 310 mm per month (Fig. 3). Favorable temperature and rainfall conditions throughout

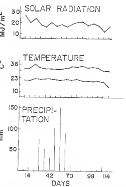

Fig. 2 Average weekly solar radiation, average weekly temperature, and total weekly precipitation for the 1978 growing season

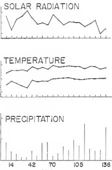

Fig. 3 Average weekly solar radiation, average weekly temperature, and total weekly precipitation for the 1979 growing season

the season likely promoted growth and development of the peanuts and the effect of Kylar as well. The rainfall, solar radiation, maximum and minimum temperatures for 1978 and 1979 growing seasons are given in Figs. 2 and 3, respectively.

Planting Date

The 1978 experiment was planted on 12 and 13 June, which was considered to be a late planting date. The influence of the late planting date combined with relatively high temperatures at the beginning of the growing season caused rapid vegetative development, early flowering, and peg initiation. Late plants had a shorter vegetative stage and flowering period which reduced their productivity. The 1979 experiment was planted on April 27 considered an optimal time for planting peanuts. No influences of planting date were observed on plants.

Diseases

Both 1978 and 1979 were characterized by attacks of Cercospora leaf spot disease at the end of the growing seasons. The conditions necessitated sampling 3 weeks in 1978 and 1 week in 1979 before the conventional harvesting date.

The 1978 Experiment

Ground-Cover and Leaf Area Index

Maximum photosynthetic production per unit area of land is only possible when full ground cover has been reached. The percentage of ground cover is the portion of the soil surface that is actually covered by the crop canopy and is directly related to the amount of solar radiation intercepted. Another factor, LAI, is important. Since Watson (1947) used the LAI concept, it has been widely used in many field crops. Leaf area index is defined as the total leaf area per unit of land area. The amount of solar energy intercepted by a crop is, however, not directly indicated by the LAI. Variation in leaf and canopy structure and planting pattern can result in different amounts of interception at a given LAI (Duncan, 1971). Different species and even cultivars have different LAIs at which full ground cover was established with the same planting pattern. McGraw (1977) indicated that with the peanut cultivar, Florunner, 100% ground cover was reached at an LAI of 3.6.

The peanuts planted in 1978 emerged in 6 days. After 16 days the first measurements were taken to calculate the LAI which would give an estimate of ground-cover. A slight difference in ground-cover was observed at the beginning of the growing season. This difference may have been partly due to herbicide damage, however, it was apparently compensated for by the time full ground cover was reached. McCloud (1974) and McGraw (1977) noted that the canopy reached full ground-cover at about 60 days when LAI was 3.6. In this experiment, however, an LAI of 3.6 was reached at day 58, indicating that complete ground-cover had been reached. Canopy photosynthesis is also maximized for this period as a result of the complete ground-cover. This relatively early full ground-cover may have been partly due to the late planting date and the climatic conditions prevailing as described above. All the treatments including controls showed increase in LAI to 5.5 at day 72. After this time the LAI of the Dixie Runner treatments increased to above 8 at day 86 (Table 5) then decreased sharply. The Florunner treatments had LAI values above 6 at day 86 (Table 6), then these values decreased sharply. No effects of Kylar have been observed on

Table 5. The effect of Kylar on leaf area index (LAI) and specific leaf weight (SLW) of Dixie Runner (DR) peanuts during the 1978 growing season

Days After Planting	Treatment DR_C		DR_{30}		DR_{44}		DR_{58}		DR_{72}		DR_{86}		DR_{100}	
	LAI	SLW*	LAI	SLW	LAI	SLW	LAI	SLW	LAI	SLW	LAI	SLW	LAI	SLW
16	0.20	4.66												
30	0.90	4.62												
44	2.51	3.73	2.90	3.61										
58	3.62	3.93	3.67	3.75	3.72	3.40								
72	5.56	4.27	5.55	4.73	5.50	4.40	5.57	4.90						
86	8.10	3.50	8.25	3.55	8.40	3.52	8.49	3.49	8.70					
100	3.20	4.00	3.10	4.01	3.30	4.20	3.29	3.99	3.30	4.00	3.31	4.01		
114	2.50	3.77	2.30	3.50	2.30	3.75	2.40	3.79	2.50	3.78	2.35	3.81	2.51	3.82

* SLW in mg/cm^2.

Table 6 The effect of Kylar on leaf area index (LAI) and specific leaf weight (SLW) of Florunner (FR) peanuts during the 1978 growing season

Days after planting	Treatment													
	FR_C		FR_{30}		FR_{44}		FR_{58}		FR_{72}		FR_{86}		FR_{100}	
	LAI	SLW*	LAI	SLW	LAI	SLW	LAI	SLW	LAI	SLW	LAI	SLW	LAI	SLW
16	0.21	4.66												
30	1.42	4.63												
44	2.48	3.73	2.50	3.58										
58	3.64	3.90	3.65	3.85	3.67	3.75								
72	5.58	4.48	5.59	4.44	5.54	4.35	5.56	4.45						
86	6.71	3.75	6.80	3.77	6.91	3.75	6.81	3.80	6.71	3.71				
100	3.00	3.70	2.90	4.00	3.10	4.01	3.20	3.99	3.10	3.95	3.01	3.75		
114	1.90	3.50	1.95	3.42	1.90	3.75	1.91	3.70	2.10	3.75	2.20	3.80	2.20	[illegible]

* SLW in mg/cm^2.

the LAI. The decline in LAI after day 86 was thought to be caused by the defoliating insects and *Cercospora* leaf spot disease.

The SLW values, which are the leaf weight in milligrams divided by the leaf area in centimeters, are presented in Tables 5 and 6. A comparison of the SLW data for all treatments within and between cultivars showed no consistent effects of Kylar on this variable. The SLW for the major part of the actively filling period stayed almost the same for all treatments. The leaves of the Kylar-treated plants appeared greener in color than the controls.

Flowering

Flowers showing color were counted at 14-day intervals. They were largely those produced during the previous 24 hours. Thus, to estimate total 14-day flower production, the daily counts should be multiplied by 14.

The first flowers were observed 30 days after planting. The rate of flowering for the first 14 days after the appearance of the first flowers was slow. In Dixie Runner cultivar, only the treatment DR$_{30}$ had a higher peak flowering of about 36 flowers per plant at day 72 while in Florunner cultivar all treatments reached the peak flowering at day 44 from planting. Inspection of data in Tables 7 and 8 shows that the effect of Kylar on flowering, if any, was slight.

Peg Number

In contrast to the flowering data, the peg and pod data are accumulative. The first pegs appeared 44 days after planting in both Dixie Runner and Florunner. The peg number of the treatments DR$_{30}$ and DR$_{50}$ (Appendix A-1) reached a maximum value of 748, and 851 pegs/m^2, respectively, at day 100 from planting as compared to the treatments

Table 7. The effect of Kylar on the flowering of Dixie Runner (DR) peanuts during the 1978 growing season.

Days after planting	Treatment*						
	DR_C	DR_{30}	DR_{44}	DR_{58}	DR_{72}	DR_{86}	DR_{100}
				no/m^2			
16							
30	52						
44	103	103					
58	194	155	103				
72	206	464	335	129			
86	13	13	90	0	77		
100	0	0	0	0	0	0	
114	0	13	0	13	0	0	0

* Average flower number/m^2 on each sampling day

Table 8 The effect of Kylar on the flowering of Florunner (FR) peanuts during the 1978 growing season

Days after planting	Treatments*						
	FR_C	FR_{30}	FR_{44}	FR_{58}	FR_{72}	FR_{86}	FR_{100}
	---------- no/m^2 ----------						
16							
30	65						
44	181	142					
58	90	90	52				
72	26	155	39	13			
86	0	0	0	0	0		
100	0	0	0	0	0	0	
114	0	0	0	0	0	0	0

* Average flower number/m^2 on each sampling day

DR_C, DR_{44}, DR_{72}, and DR_{86} with 477, 632, 348, and 503 pegs/m^2, respectively. The peg number of the treatment FR_{44} (Appendix A 2) in Florunner cultivar was the highest with 977 pegs/m^2 at day 100, followed by FR_{86} with 710, and FR_C with 659 pegs/m^2. All peg counts decreased sharply at day 114 (Figs. 4 and 5, Tables A-1 and A-2) in all treatments. The fluctuation in the peg counts was attributed to pod formation rather than to the effect of Kylar. The 44-day treatments in Florunner (FR_{44}) in contrast to DR_{44} in Dixie Runner, showed a higher value for peg number (Table A-2). The formed peg or any peg which had an indication of swelling or any forming pod was counted as a peg. This method of counting increased peg number and decreased the pod number counted.

Pod Number

The pod number of all peanut cultivars are presented in Appendix A-3, A-4, A-5, and A-6. The first measurements were taken by day 44 after planting which was the same time as for the first peg count. The latter was delayed because of the 14-day intervals of sampling. The pod count for Dixie Runner began at day 58 after planting when the first pods were already formed. The pod-count curves for all Dixie Runner treatments are shown in Fig. 6. Dixie Runner control (DR_C) had a steadily increasing pod count up to about day 100 (Fig. 6), at this time the pod number reached 37 pods per plant, then decreased to 30 pods per plant at day 114. The 30-day, Kylar-treated Dixie Runner (DR_{30}) showed an increased pod number of 40 pods per plant at day 72. It decreased slightly by day 86, then increased steadily up to 44 pods until harvest. The 44-day treated Dixie Runner (DR_{44}) had a steadily increasing pod count up to day 100 (Fig. 6). At day 100, pod numbers declined. All Dixie Runner treatments except the DR_{30} and DR_{72}, showed

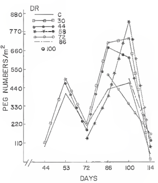

Fig 4 Bi-weekly number of pegs for Dixie Runner peanut receiving different treatments of Kylar during the 1978 growing season

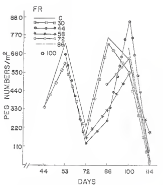

Fig. 5 Bi-weekly number of pegs for Florunner peanut receiving different treatments of Kylar during the 1978 growing season

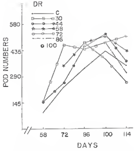

Fig. 6. Bi-weekly number of pods for Dixie Runner peanut receiving different treatments of Kylar during the 1978 growing season

an increasing pod count up to day 100 and then declined by day 114 (Fig. 6). The DR_{72} treatment pod count was 41 pods per plant by day 86 and declined until harvest. The DR_{30} treatment had the highest pod count at harvest with 44 pods per plant. Trends for pod numbers for all Florunner treatments are presented in Fig. 7. The FR_{58} treatment had the lowest pod count. It increased steadily up to day 72, at this time the pod-count curve plateaued at approximately 32 pods per plant, then declined to about an average of 25 pods at harvest. All Florunner treatments showed a decreasing pod count from the 100th day until harvest (Fig. 7). The decline in pod number curves was thought to have been partly due to weather conditions prevailing and mostly to the Cercospora leafspot disease which might have weakened the peg attachments and caused pod losses in soil. The FR_{30} treatment had a steadily increasing pod count up to day 100 with an average of 56 pods per plant, the largest pod count, followed by FR_{72} by day 86 and FR_{44} about day 100, averaging 48 pods each per plant (Fig. 7). At day 100 the FR_{86} treatment reached an average of 42 pods per plant. The seeds began to fill by day 58 for Florunner and day 72 for Dixie Runner.

The shelling percentage increased to a maximum of 72 for DR_C, 75 for DR_{30}, 76 for DR_{44}, 77 for DR_{58}, 73 for DR_{72}, 72 for DR_{86}, and 76 for DR_{100} at harvest. At harvest the same Dixie Runner treatments had an average pod weight of 0.77, 0.75, 0.84, 0.80, 0.81, 0.74, and 0.76 g/pod, respectively. Florunner treatments showed increasing shelling percentages to a maximum of 82 for FR_C, FR_{30}, and FR_{86} treatments, a maximum of 81 for FR_{58}, and 80 for FR_{44}, FR_{58}, and FR_{100} at harvest. At this time the average pod weight was 1.0 for FR_C and

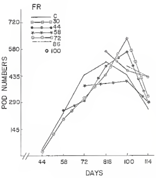

Fig. 7 Bi-weekly number of pods for Florunner peanut receiving different treatments of Kylar during the 1978 growing season

FR_{30}, 1.04 g/pod for FR_{44}, 1.08 g/pod for FR_{58}, FR_{86} and FR_{100} treatments. The FR_{72} treatment had an average pod weight of 1.1 g/plant at harvest.

Stem Length

Both the main-stem length and the length of the first eight longest cotyledonary branches are presented in Tables 9 and 10. In Dixie Runner cultivar, the main-stem as well as the branch length showed lower maximum values in Kylar-treated plants than the control. The DR_{72} treatment, however, showed no affect at all, either in the main-stem or in branch length (Table 9). In Florunner (Table 10), all Kylar-treated peanuts showed lower values than the control. A reduction of the cotyledonary branch length was observed only in FR_{44} and FR_{58} treatment. The FR_{44} treatment was the most responsive to Kylar with 20.5% reduction of the main-stem and 15.1% reduction of the lateral-branch length followed by FR_{58} with 6.04, and 8.54% reduction of the main-stem, and lateral, respectively (Table 10). In Dixie Runner, the three early treatments (DR_{30}, DR_{44}, and DR_{58}) did have more effect on the main-stem and branch length. The later treatments had little or no effect on main-stem and branch length (Table 9).

Growth Rate

Growth analyses are helpful in understanding the general pattern of plant development. Growth of Dixie Runner (Figs. 8, 9, 10, 11, 12, 13, and 14) and Florunner (Figs. 15, 16, 17, 18, 19, 20, and 21) followed sigmoid curves. The early geometric phase covered the first 7 weeks. It was characterized by the accumulation of dry matter in the vegetative components. The difference between two consecutive points of any series

Table 9. Effect of Kylar on main-stems and branches of Dixie Runner peanuts during the 1978 growing season.

Treatments	Main-stem length			Branch length		
	Average	% of Control	Reduction	Average	% of Control	Reduction
	cm		%	cm		%
DR_C	52.3	100.0	0	579.1	100.0	0
DR_{30}	39.0	74.5	(-)25.4	515.1	88.9	(-)11.0
DR_{44}	42.0	80.2	(-)19.7	558.0	96.3	( ) 3.[illegible]
DR_{58}	42.0	80.2	(-)19.7	531.8	91.8	(-) [illegible]
DR_{72}	57.3	109.5	(+) 9.5	613.5	105.9	[illegible]
DR_{86}	51.0	97.4	(-) 2.5	620.0	107.0	[illegible]
DR_{100}	48.3	92.3	(-) 7.7	568.5	98.1	[illegible]

(+) more than the control.

(-) less than the control

Table 10 Effect of Kylar on main stems and branch length of Florunner peanuts during the 1978 growing season.

Treatments	Main-stem length			Branch length		
	Average	% of Control	Reduction	Average	% of Control	Reduction
	cm		%	cm		%
FR_C	49.7	100.0	0	478.5	100.0	0
FR_{30}	47.0	94.6	(-) 5.4	511.3	106.8	(+) 6.8
FR_{44}	39.5	79.4	(-)20.5	406.1	84.8	(-)15.1
FR_{58}	46.7	93.9	(-) 6.0	437.6	91.4	(-) 8.5
FR_{72}	47.2	94.9	(-) 5.0	502.1	104.9	(+) 4.9
FR_{86}	48.0	96.5	(-) 3.4	516.5	107.9	(+) 7.9
FR_{100}	48.3	97.1	(-) 2.8	519.3	108.5	(+) 8.5

(+) more than the control

(-) less than the control

gives the average crop-growth rate over the period. The linear growth phase for both cultivars began around day 44 after planting.

The crop-growth rate from day 44 to day 86 for Dixie Runner treatments was 210 kg/ha/day for DR_C treatment. The equation for this relationship is $y = -7522 + 207.7x$ with a coefficient of determination (r^2) of 0.95 and a standard error of the slope estimate of 31 kg/ha/day. The DR_{30} treatment had a crop-growth rate (CGR) of 210.6 kg/ha/day. The equation for this relationship is $y = -7473 + 210.6x$ with an r^2 of 0.99, a standard error of the slope estimate of 11 kg/ha/day. The DR_{44} treatment had CGR of 208.0 kg/ha/day ($y = -7792 + 208.0x$) with an r^2 of 0.98 and a standard error of the slope estimate of 32 kg/ha/day. The treatments DR_{58}, DR_{72}, DR_{86}, and DR_{100} had a crop-growth rate of 209.6 ± 32, 188.5 ± 44, 210.1 ± 33, and 190.6 ± 33 kg/ha/day, with an r^2 of 0.95, 0.90, 0.95, and 0.88, respectively. The equations for these relationships and the coefficient of determination (r_2) are presented in Table 13.

The pod-growth rate calculated from day 72 to day 100 was 59.6 ± 29 kg/ha/day for DR_C, 70.5 ± 0.9 kg/ha/day for DR_{30}, 57.6 ± 5.6 kg/ha/day for the DR_{44} treatment. The treatments DR_{58} and DR_{72} had 46.3 ± 5.6 kg/ha/day and 74.5 ± 3 kg/ha/day, respectively. The pod-growth rates for the late treatments were 42.4 ± 12 kg/ha/day for DR_{86} and 53.2 ± 6 kg/ha/day for DR_{100}. The pod-growth rates of DR_{30} and DR_{72} showed a substantial increase as compared to DR_C, the treatment control. This increase was attributed to the effect of Kylar. The equations for the relationship and coefficient of determination are in Table 13. The final yields are shown in Table 17.

Table 11 Effect of Kylar on pod weight when applied at different growth stages of Dixie Runner peanut in 1978

Days after planting	Treatment						
	DR_C	DR_{30}	DR_{44}	DR_{58}	DR_{72}	DR_{86}	DR_{100}
	g/m^2						
58	7.5	13.0	11.2				
72	37.2	145.2	73.3	70.3			
86	124.6	178.0	213.9	266.7	181.8		
100	246.0	267.4	266.6	432.5	233.4	275.3	
114	297.3	405.4	343.2	426.6	234.0	268.1	281.9

Table 12. Effect of Kylar on pod dry weight when at different growth stages of Florunner peanut in 1978.

Days after planting	Treatment						
	FR_C	FR_{30}	FR_{44}	FR_{58}	FR_{72}	FR_{86}	FR_{100}
	g/m^2						
44	0.9	2.9					
58	56.2	39.4	58.1				
72	219.1	145.8	150.6	182.0			
86	380.6	346.1	405.4	303.4	439.2		
100	399.8	625.7	498.3	362.5	458.6	431.8	
114	352.0	363.9	338.5	350.6	533.1	515.6	474.7

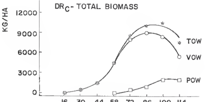

Fig 8 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for control treatment on Dixie Runner peanut during the 1978 growing season.

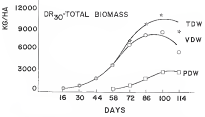

Fig 9. Total biomass dry weight (TDW) partitioning into vegetative (VDW), and pod components (PDW) for DR_{30} treatment on Dixie Runner peanut during the 1978 growing season.

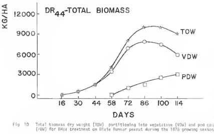

Fig 10 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR44 treatment on Dixie Runner peanut during the 1978 growing season.

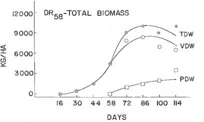

Fig 11 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{58} treatment on Dixie Runner peanut during the 1978 growing season

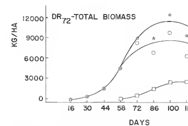

Fig 12 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR$_{72}$ treatment on Dixie Runner peanut during the 1978 growing season

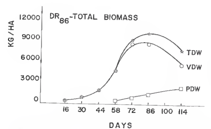

Fig. 13 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR$_{86}$ treatment on Dixie Runner peanut during the 1978 growing season

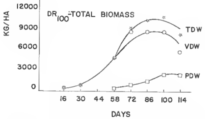

Fig 14 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for DR_{100} treatment on Dixie Runner peanut during the 1978 growing season.

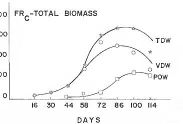

Fig. 15 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod co
(POW) for FR$_C$ treatment on Florunner peanut during the 1978 growing season

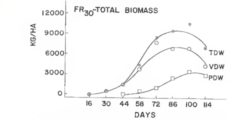

Fig. 16 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{30}$ treatment on Florunner peanut during the 1978 growing season

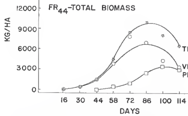

Fig. 17. Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{44}$ treatment on Florunner peanut during the 1978 growing season.

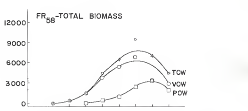

Fig. 18. Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{58}$ treatment on Florunner peanut during the 1978 growing season.

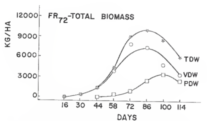

Fig. 19 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{72}$ treatment on Florunner peanut during the 1978 growing season

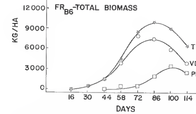

Fig 20 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{B6}$ treatment on Florunner peanut during the 1978 growing season

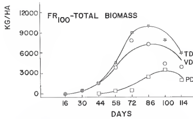

Fig 21 Total biomass dry weight (TDW) partitioning into vegetative (VDW) and pod components (PDW) for FR$_{100}$ treatment on Florunner peanut during the 1978 growing season

Table 13 Linear regression equations indicating the effect of Kylar on crop-growth rate and pod-growth rate expressed in kg/ha/day, when applied at different growth stages of the Dixie Runner peanuts in 1978

Treatments	Linear regression equation					
	Crop-growth rate ± SEE	Days	r^2	Pod-growth rate ± SEE	Days	r^2
DR_C	$y = -7522 + 209.7x \pm 31$	44-86	0.95	$y = -3907 + 59.6x \pm 29.0$	72-100	0.97
DR_{30}	$y = -8344 + 210.6x \pm 11$	44-86	0.99	$y = -4489 + 70.5x \pm 0.9$	72-100	0.99
DR_{44}	$y = -7792 + 208.0x \pm 32$	44-86	0.98	$y = -3330 + 57.6x \pm 5.6$	72-100	0.99
DR_{58}	$y = -7517 + 209.6x \pm 32$	44-86	0.95	$y = -2483 + 46.3x \pm 5.6$	72-100	0.98
DR_{72}	$y = -6390 + 188.5x \pm 44$	44-86	0.90	$y = -4840 + 74.5x \pm 3.0$	72-100	0.99
DR_{86}	$y = -7545 + 210.1x \pm 33$	44-86	0.95	$y = -2591 + 42.4x \pm 12.0$	72-100	0.99
DR_{100}	$y = -6089 + 190.6x \pm 33$	44-86	0.88	$y = -3428 + 53.2x \pm 6.0$	72-100	0.98

Table 14. Linear regression equations indicating the effect of Kylar on crop-growth rate, and pod growth rate expressed in kg/ha/day, when applied at different growth stages of the Florunner peanuts in 1978

Treatments	Linear regression equation					
	Crop-growth rate ± SEE	Days	r^2	Pod-growth rate ± SEE	Days	r^2
FR_C	$y = -7647 + 212.3x \pm 33$	44-86	0.95	$y = -5984 + 95.3x \pm 18$	72-100	0.96
FR_{30}	$y = -7385 + 206.3x \pm 31$	44-86	0.95	$y = -5507 + 90.2x \pm 15$	72-100	0.97
FR_{44}	$y = -7544 + 209.8x \pm 31$	44-86	0.95	$y = -5189 + 87.5x \pm 22$	72-100	0.94
FR_{58}	$y = -6665 + 186.7x \pm 10$	44-86	0.99	$y = -5348 + 89.7x \pm 22$	72-100	0.94
FR_{72}	$y = -75673 + 210.7x \pm 31$	44-86	0.95	$y = -5971 + 94.7x \pm 7$	72-100	0.99
FR_{86}	$y = -7570 + 210.0x \pm 31$	44-86	0.95	$y = -5837 + 92.1x \pm 7$	72-100	0.99
FR_{100}	$y = -7523 + 208.9x \pm 33$	44-86	0.95	$y = -5693 + 91.5x \pm 20$	72-100	0.95

The crop-growth rates for Florunner treatments, calculated from day 44 to day 86 were 212.3 ± 32 kg/ha/day for FR_C, 206.2 ± 31 kg/ha/day for FR_{30}, and 209.8 ± 31 kg/ha/day for FR_{44}. The treatment FR_{58} had a crop-growth rate of 185.7 ± 10 kg/ha/day, the lowest among the Florunner treatments. The treatment FR_{72} reached a pod-growth rate of 210.7 ± 31 kg/ha/day. FR_{86} had 210.0 ± 31 and FR_{100} had 209.9 ± 33 kg/ha/day (Table 14). The Florunner treatments were not significantly different in crop-growth rate. The equations for the relationship, the coefficient of determination (r^2) and the standard error of the slope estimates are shown in Table 14.

The pod-growth rates of Florunner treatments are calculated from day 72 to day 100. The treatment control, FR_C, and treatment FR_{72} had the highest pod-growth rates. Both reached a pod-growth rate of 95.3 ± 19 and 94.7 ± 7 kg/ha/day, respectively. The treatment FR_{44} had the lowest pod-growth rate with 87.5 ± 22 kg/ha/day, followed by the treatment FR_{58} with 89.7 ± 22 kg/ha/day, followed by the treatment FR_{58} with 89.7 ± 22 kg/ha/day. The 30-day Kylar treatment, FR_{30}, had a pod-growth rate of 90.2 ± 15 kg/ha/day. The treatments FR_{86} and FR_{100} reached pod-growth rates of 92.1 ± 7 kg/ha/day and 91.5 ± 20 kg/ha/day, respectively. The equations for these relationships and their coefficient of determination (r^2) are in Table 14. The effect of Kylar, if any, was not beneficial to the pod-growth rate for the Florunner cultivar. The final yields of different Florunner treatments are presented in Table 17.

Partitioning of Assimilates

As the seed began to fill, the amount of photosynthate needed for filling the pods increased. During this period the plants increased the partitioning of photosynthate to pod development. Partitioning is defined as the fraction of daily photosynthate that is allocated to pods and seeds as opposed to vegetative growth. Duncan et al. (1978) defined partitioning as the division of recent assimilate between reproductive and vegetative plant parts.

McGraw (1978) stated that the apparent physiological aspect that was most responsible for increased yield was an increase in the partitioning factor. The partitioning factor is a ratio of the amount of photosynthate partitioned to the yield component of the crop divided by the total amount of photosynthate available for crop growth. It can be estimated using the pod-growth rate corrected for the increased oil and protein in the seed divided by the crop-growth rate determined during the linear growth phase. The correction factor for increased oil and protein in the seed, calculated by McGraw (1977) is equal to 1.65.

The partitioning factors for all treatments of the two peanut cultivars are presented in Table 15. Dixie Runner control had a partitioning factor of 0.47 which was similar to the 0.46 partitioning factor of the 44-day, Kylar-treated Dixie Runner and to the 0.46 partitioning factor of the 100-day, Kylar-treated Dixie Runner. The 58-day, Kylar-treated Dixie Runner had a partitioning factor of 0.36 similar to the 0.33 partitioning factor of the 86-day, Kylar-treated Dixie Runner. Inspection of data in Table 15 shows an improvement in partitioning factors of the 30-and 72-day Kylar treatments. Plants

Table 15. The effect of Kylar on partitioning factors of Dixie Runner and Florunner cultivars during the 1978 growing season

Treatments	Partitioning factors			
	Dixie Runner	%	Florunner	%
C	$\frac{59.6x1.65}{209.7} = 0.468$	46.8	$\frac{95.3x1.65}{212.3} = 0.740$	74.0
30	$\frac{70.5x1.65}{210.6} = 0.552$	55.7	$\frac{90.2x1.65}{206.8} = 0.719$	71.9
44	$\frac{57.6x1.65}{208.0} = 0.456$	45.6	$\frac{87.5x1.65}{209.8} = 0.688$	68.8
58	$\frac{46.3x1.65}{209.6} = 0.364$	36.4	$\frac{89.7x1.65}{186.7} = 0.792$	79.2
72	$\frac{74.5x1.65}{188.5} = 0.647$	64.7	$\frac{94.7x1.65}{210.7} = 0.741$	74.1
86	$\frac{42.4x1.65}{210.1} = 0.332$	33.2	$\frac{92.1x1.65}{210.0} = 0.723$	72.3
100	$\frac{53.2x1.65}{190.6} = 0.460$	46.0	$\frac{91.5x1.65}{209.9} = 0.719$	71.9

Table 16. The effect of Kylar on the length of the filling period when applied at different growth stages of Dixie Runner and Florunner peanuts in 1978

Dixie Runner treatments	Length of filling period		
	Days	Florunner treatments	Days
DR_C	37	FR_C	30
DR_{30}	39	FR_{30}	33
DR_{44}	55	FR_{44}	37
DR_{58}	69	FR_{58}	21
DR_{72}	51	FR_{72}	25
DR_{86}	51	FR_{86}	29
DR_{100}	41	FR_{100}	24

Table 17 Final yield of Dixie Runner and Florunner peanuts during the 1978 growing season

Treatment	3-plant-sample yield		21-plant-sample yield	
	Dixie Runner	Florunner	Dixie Runner	Florunner
	kg/ha			
C	3015ab	3572a	2200d	2809b
30	3235a	3398ab	2732c	2926ab
44	2819b	3265b	3118b	3216a
58	3220a	2973b	3504a	1925de
72	2496c	3840a	2734c	2327d
86	2068cd	2844c	2124d	2670bc
100	2297c	3050b	2199d	2156d

* Treatments in each column with different letters are significantly different. Largest values designated by 'a".

from the DR_{30} treatment had improved partitioning factor of 0.55 and the treatment DR_{72} had 0.65 partitioning factor. This improvement in partitioning factors of Dixie Runner cultivar was attributed to the effect of Kylar.

The partitioning factors for the Florunner treatments were not significantly different (Table 15). Plants from the FR_C treatment had a partitioning factor of 0.73 similar to the 0.74 partitioning factor of the FR_{72} treatment. Plants from treatments FR_{30}, FR_{86}, and FR_{100} each had a partitioning factor of 0.72. The lower partitioning factor was reached by the FR_{44} treatment. The Kylar application did not affect the partitioning factor of Florunner peanuts.

The 1978 experimental conditions as discussed earlier were unfavorable and unsuitable, however, some observations have been made and trends established. First, Kylar reduced vegetative growth, increased pod number, and improved the partitioning factor of Dixie Runner cultivar. Secondly, this first experiment gave a clue to the amount and time of Kylar application.

The 1979 Experiment

Growth Analysis

Ground-cover and leaf area index. The plant canopy can only function at its maximum potential when all the incoming radiation is intercepted. Without a complete gound-cover, solar radiation will reach the ground instead of the leaves and will not be utilized in photosynthesis. The percent of ground-cover is the percent of the soil surface that is actually covered by the crop canopy and is related directly to the amount of solar radiation intercepted. With variable leaf and canopy structures and plant densities, crop species require different LAI to intercept all the incoming radiation.

In Dixie Runner, the lower-yielding peanut cultivar, the treatment control (DR_C), had an LAI of 4.2 when complete ground-cover was reached, and by day 66 the LAI had increased to 7.2. At this time the LAI appeared to plateau at an average of 7.0 for the next 3 weeks. The peak of LAI of 10.2 was reached on day 94. At day 115, 4 weeks before harvest, the LAI began decreasing slowly. The decline was attributed to leaf spot (Cercospora sp.) disease, insect attack, and leaf senescence. At harvest the LAI was 3.0 (Fig. 22). The value of 3.0 is required for complete ground-cover. A reduction in LAI below that value is unlikely to have a sizeable effect on photosynthate production. A reduction in LAI below that required for complete goundcover will affect photosynthate production as not all the solar radiation will be intercepted by the crop canopy. The LAI value for Dixie Runner control was relatively higher during the last week, and could have affected photosynthate production.

The Kylar-treated Dixie Runner 45 days from planting (DR_{45}) had an LAI of about 2.7 when complete ground-cover was reached (Fig. 22). By day 73 the LAI had increased to 5.5. At this time the LAI appeared to plateau with an average of 6.5 for the next 4 weeks. The peak LAI of 10.6 was reached on day 108. At day 115, 4 weeks before harvest, the LAI began to decrease slowly. At harvest the LAI was 5.1 which is above that required for a complete ground-cover. Then, the DR_{45} treatment would not be expected to have its potential yield reduced by incomplete ground-cover.

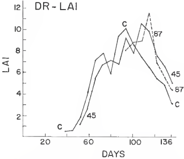

Fig. 22 Leaf area index during the 1979 growing season for Dixie Runner treatments.

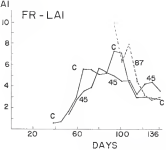

Fig. 23 Leaf area index during the 1979 growing season for Florunner treatments.

The Kylar-treated Dixie Runner 87 days after planting (DR_{87}) had an LAI of about 4.2 when complete ground-cover was reached, and by day 66 the LAI had increased to 7.2. At this time the LAI appeared to plateau with an average of 6.9 for the next 3 weeks. The peak LAI of 11.6 was reached on day 115. At day 122, 3 weeks before harvest, the LAI began to decrease slowly. At harvest the LAI was 4.4 (Fig. 22). This value is above that required for a complete ground-cover. Again the DR_{87} treatment would not be expected to have its potential yield reduced by incomplete ground-cover.

In Florunner, the higher yielding peanut cultivar, the treatment control (FR_C) had an LAI of 3.2 when complete ground-cover was reached. By day 66 the LAI increased to 5.6. At this time the LAI appeared to plateau at an average of 5.3 for the next 4 weeks. The peak LAI of 7.3 was reached on day 94 (Fig. 23). At day 101, 5 weeks before harvest, the LAI began to decrease rapidly. The LAI had already decreased to 2.9 by day 115, which is slightly below that required for complete ground-cover. Thus, FR_C did not maintain a complete ground-cover 2 to 3 weeks before harvest. This rapid decrease in LAI was attributed first to insect attack and leaf senescence, and secondly to severe leaf spot disease which began by day 122.

The Kylar-treated Florunner (FR_{45}) 45 days from planting, had an LAI of 3.0 when complete ground-cover was reached, and increased slowly to the peak LAI of 5.6 by day 80. At day 87, the LAI began to decrease slowly (Fig. 23). At harvest the LAI was 3.6 which is above that required for a complete ground-cover. Thus, FR_{45} did maintain a complete ground-cover throughout the harvest.

The Kylar-treated Florunner (FR$_{87}$) 87 days after planting, had an LAI of 3.2 when the ground-cover was reached. By day 66 the LAI increased to 5.6 and appeared to plateau with an average of 5.3 for the next 4 weeks. The peak LAI of 9.8 was reached on day 94 (Fig. 23). By day 108, the LAI began decreasing rapidly. At harvest the LAI was 3.0 which is that required for complete ground-cover. Then, FR$_{87}$ as well as FR$_{45}$ would not be expected to have their potential yield reduced by incomplete ground-cover.

The effect of Kylar on the LAI of both Dixie Runner and Florunner cultivars studied, showed no positive effects in reducing and maintaining the LAI as compared to the controls. Further increase in LAI to above 7.0 would not have measurable affect on the growth rate which is consistent with the results obtained by Brown et al. (1973), Duncan et al. (1978). Since peanuts reached a complete ground-cover at about LAI of 3.0, and intercepted about 95% of the incoming solar radiation, an LAI of 5.5 would be optimal and the value of 6.0 to 7.0 would be maximal. An LAI above 7.0 would not be considered beneficial. McGraw (1977) stated that once 100% ground-cover was reached, increased LAI did not significantly increase the net photosynthesis. Exception was made for FR$_{45}$ which had the peak LAI of 5.6 compared to 7.3 for FR$_{C}$. The FR$_{87}$ Treatment had the peak LAI of 9.8 which was above that of FR$_{C}$. In Dixie Runner cultivar, both DR$_{45}$ and DR$_{87}$ had the peak LAI's of 10.6 and 11.6, respectively. These values are close to or above that of 10.2 for DR$_{C}$. The leaves of plants treated with Kylar appeared greener than controls. This green coloration seems to support the previous results by Brittain (1967), Baumann and Norden (1971a), and Perry (1972). Brittain (1967) found that the leaves of plants treated

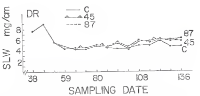

Fig 24 Specific leaf weight measured weekly during the 1979 growing season for the Dixie Runner cultivar treatments.

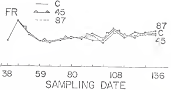

Fig 25 Specific leaf weight measured weekly during the 1979 growing season for the Florunner cultivar treatments.

with Kylar contained a higher concentration of chlorophyll than controls, and rates of CO_2 assimilation were increased by Kylar treatment. These findings suggest that Kylar may directly increase the photosynthetic efficiency of a unit area of canopy.

The SLW values (the leaf weight in milligrams divided by leaf area in centimeters) are presented in Figs. 24 and 25. The SLW of Kylar-treated Dixie Runner peanut plants increased slightly up to day 67 from planting and plateaued until harvest as compared to the control (Fig. 24). The color effect in Kylar-treated Florunner was not accentuated as much as in Dixie Runner. No consistent effect of Kylar on SLW of treated Florunner (Fig. 25).

Interestingly, there was a striking secondary effect of Kylar in this study. The canopy of all Kylar-treated Dixie Runner plants showed LAI values of 3.0 or above, thus maintaining relatively good canopy structure, and a complete ground-cover with dark green leaves until harvest. In contrast, the canopy of the treatment control appeared deteriorated and was light green in color with LAI value below 3.0, and it appeared to be more sensitive to Cercospora leaf spot than Kylar-treated plants. This secondary effect may be a positive indication for the use of Kylar since Kylar seems to increase the resistance of Dixie Runner peanuts to Cercospora leaf spot.

Flowering. By about the fifth week after planting, all the peanut cultivars had begun to flower. The flower-frequency curve for Dixie Runner (Fig. 26) describes an increasing flower production to a peak of 62 flowers for DR_C and DR_{67} and 71 flowers for DR_{45} per plant on day 73. After this the flower production declined rapidly but never completely ceased The flower production was only about one flower for DR_C and DR_{45} and five flowers for DR_{87} per plant at harvest

Florunner had a flower-frequency curve (Fig. 27) which increased to a peak of 51 flowers per plant for FR_C and FR_{87} on day 66 Treatment FR_{45} showed a peak of 92 flowers per plant on day 73. After this the flower production declined rapidly in all treatments After day 94, flowering ceased.

Dixie Runner, the oldest low-yielding cultivar, continued flowering for the entire growing season The newer, higher-yielding cultivar (Florunner) ceased flowering 6 weeks before harvest. Florunner flowered about 3 weeks.

This study showed that the effect of Kylar on flowering, if any, was slight This again is consistent with the results obtained by Bockelee-Morvan et al. (1975) The peak flowering was delayed for about one week and the flower production per plant at this time was more for the 45-day treatments (DR_{45} and FR_{45}) compared to that of the controls (DR_C and FR_C) and the 87-day treatments (DR_{87} and FR_{87}) in both Dixie Runner and Florunner cultivars (Figs 26 and 27)

Pegging. The first pegs appeared 2 weeks after the first flower for both Dixie Runner and Florunner cultivars All of the treatments studied had sufficient quantities of pegs for production of higher yields. There were always unfilled pegs available even at harvest (Figs. 28 and 29) The peg-frequency curves for the two peanut cultivars in all the treatments showed an increase in peg count up to about day 87. After this time the peg count decreased sharply This sharp decline was thought to be attributed to pegs forming new pods By day 115 to 122 the peg-frequency curves showed sharp increases in

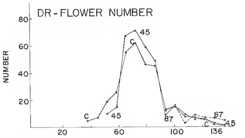

Fig. 26 Weekly number of flowers for Dixie Runner treatments during the 1979 growing season.

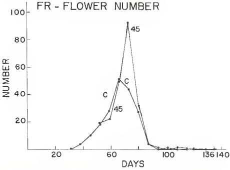

Fig 27 Weekly number of flowers for Florunner treatments during the 1979 growing season

peg counts. These increases were attributed to a favorable growing season and to a stabilized pod count. Smith (1954) stated that peanut had no abscission layer for eliminating unfilled pegs. The pod count had already stabilized on day 94 for Florunner peanuts and day 101 for Dixie Runner.

Pod formation and pod fill. The peanut cultivars began producing pods 1 week after the first pegs were formed. Dixie Runner, the oldest lower-yielding cultivar, had a steadily increasing pod count up to about day 101 (Fig. 30). At day 101 the pod frequency curve plateaued at approximately 39 pods per plant for DR_C, 91 pods per plant for DR_{45}, and 68 pods per plant for DR_{87} until harvest. The seeds began to fill about day 73 (Tables 18, 19, 20). The effect of Kylar on pod formation was the most striking. The pod number increase rate was 35.0 and 28.0 pods/m^2 per day for DR_{45} and DR_{87}, respectively, compared to 8.0 pods/m^2/day for the control, DR_C (Table 32). The shelling percentage increased to a maximum of 66.6 for the control, DR_C, and 68.5 for DR_{87}. DR_{45}, which had the highest pod number increase rate, had the lowest shelling percentage of 61 at harvest (Tables 18, 19, 20, 32). At harvest, Dixie Runner had an average pod weight of 0.74, 0.76, and 0.85 g/pod for DR_{45}, DR_{87}, and DR_C, respectively. These findings are consistent with the statement by Brown and Ethredge (1974) that there was a trend for increases in the number of pods per plant by Kylar in Spanish cultivars in all 3 years and in runner and Virginia types in 1970, and that the weight per 100 pods was reduced by Kylar in the Spanish cultivars in 1972.

Florunner, the new higher-yielding cultivar, also had a steadily increasing pod count up to about day 94 (Fig. 31). Florunner reached

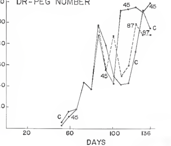

Fig. 28 Weekly number of pegs for Dixie Runner treatments during the 1979 growing season.

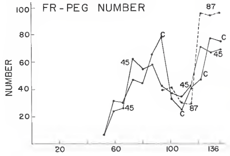

Fig 29. Weekly number of pegs for Florunner treatments during the 1979 growing season

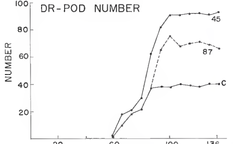

Fig. 30 Weekly number of pods for Dixie Runner treatments during the 1979 growing season

pod count stability by day 94. A pod count of approximately 68 pods per plant was maintained for all treatments from day 94 to harvest. Kylar had no effects on pod formation in Florunner cultivar. The pod number increase rate was 21.3, 21.7, and 22.8 pods/m^2/day for FR$_{45}$, FR$_C$, and FR$_{67}$, respectively (Table 32). These differences were not significant. The shelling percentage increased to a maximum of 85, 86.2, and 87 for FR$_{67}$, FR$_{45}$, and FR$_C$, respectively, at harvest. Florunner had an average pod weight of 0.99, 1.0, 1.04 g/pod for FR$_C$, FR$_{45}$, and FR$_{67}$, respectively, at harvest.

Stem length. In Dixie Runner cultivar, both the main-stem (Fig. 32) and the length of the first eight longest cotyledonary branches (Fig. 34) showed higher maximum values in control than in Kylar-treated peanuts. The lower values were mainly attributed to the effect of Kylar on the vegetative growth. Both main-stem and cotyledonary branches continued to grow throughout the season. The DR$_{45}$ and DR$_{67}$ treatments indicated shorter main-stems and shorter branches as compared to control treatments. The most consistent effect of Kylar was a reduction of plant height. The percentage of reduction in main-stem and branches for DR$_{45}$ and DR$_{67}$ as compared to DR$_C$ is presented in Table 24. This is consistent with the results obtained by Brittain (1967), Baumann and Norden (1971a), and Brown and Ethredge (1974).

In Florunner cultivars, the main-stem length (Fig. 33) showed higher values in control than in Kylar-treated peanuts. This indicates that Kylar had an effect, even though slight, on the main-stem elongation. Plants from the FR$_{45}$ and FR$_{67}$ treatments (Fig. 33) showed shorter main stems as compared to the FR$_C$. The length of the first eight cotyledonary branches (Fig. 35) had not been affected by Kylar.

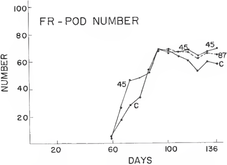

Fig 31. Weekly number of pods for Florunner treatments during the 1979 growing season

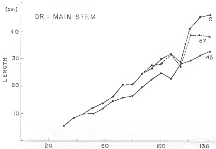

Fig 32. Length of the main stem of Dixie Runner treatments measured weekly during the 1979 growing season

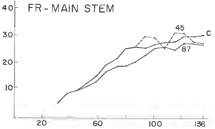

Fig 33 Length of the main stem of Florunner treatments measured weekly during the 1979 growing season.

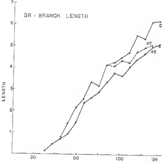

Fig 34: Average length of the eight longest branches of Dixie Runner treatments, measured weekly during the 1979 growing season

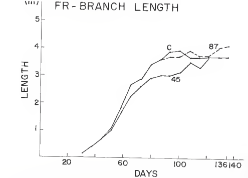

Fig. 35. Average length of the eight longest branches of Florunner treatments, measured weekly during the 1979 growing season

The elongation of both main stems and cotyledonary branches stopped and reached a plateau from day 101 to harvest 136 days after planting (Fig. 35). The percent of reduction in Dixie Runner and Florunner (Table 24) indicated that Kylar had more effect on Dixie Runner peanuts than on Florunner.

Growth Analysis

Growth analyses are helpful in understanding the general pattern of plant development. The growth of Dixie Runner followed a sigmoid curve (Figs. 36, 37, 38). The early geometric phase covered the first 7 weeks. It was characterized by the accumulation of dry matter in the vegetative components. The largest component in terms of dry weight during this phase was the leaf (Tables 18, 19, 20). The leaves of the plant comprise as much as 50.0, 50.5, and 50.0% for DR_C, DR_{45}, and DR_{87}, respectively, of the total plant dry weight during this phase. The roots initially constituted 11.9, 11.0, and 11.9% of the dry weight for DR_C, DR_{45}, and DR_{87}, respectively, but rapidly decreased to 1.03 for DR_C, 0.9 for DR_{45}, and 1.1% for DR_{87} by the end of the early geometric phase. The stem component of DR_C, DR_{45}, and DR_{87} was 38.0, 38.0, and 38.0%, respectively, of the plant at the first sampling period and increased throughout this phase (Tables 25, 26, 27).

The linear growth phase began around day 59 and continued for approximately 10 weeks. The crop-growth rate from day 59 to day 94 was 164.0 kg/ha/day for DR_C, 180.0 kg/ha/day for DR_{45}, and 163.8 kg/ha/day for DR_{87} (Tables 31 and 33). The equation for this relationship for DR_C is $y = -6704 + 164.0x$ with a coefficient of determination (r^2) of 0.94 and a standard error the slope estimate of 20 kg/ha/day. The equation for DR_{45} is $y = -8041 + 180.0x$ with a coefficient of determination (r^2)

of 0.99 and a standard error of the slope estimate of 7 kg/ha/day. The equation for DR_{87} is y = -6672 + 164.0x with a coefficient of determination (r^2) of 0.94 and a standard error of the slope estimate of 27 kg/ha/day. This period from day 59 to day 94 was during the linear growth pahse and 3 weeks after seed development began. These growth rates may be used to estimate the amount of photosynthesis available for crop growth. During this period the canopy was not greatly affected by insect attack or disease.

After day 73, the seeds of Dixie Runner began to fill and the development of the plants began to shift from total vegetative growth to partial reproductive growth (Tables 18, 19, 20). As the pod count increased and the plants partitioned more of the available photosynthate into the reproductive component, the vegetative components began to decrease in rate of growth due to lack of photosynthate.

In the DR_C treatment, the reduction in photosynthate available for vegetative growth was demonstrated by the flower-count decline which began after day 73 (Fig. 26). The LAI plateaued by this time (Fig. 22). The leaf dry weight plateaued by day 87 (Table 18). The pod count stabilized at approximately 39 pods per plant by day 101 (Fig. 30). The stem elongation slowed (Fig. 34) and the stem dry weight stopped increasing (Table 18) by day 116. The total biomass curve slowed in rate of increase about day 94 (Fig. 36). The total biomass growth rate decreased due to leaf loss and also because more photosynthate is required in the production of dry matter in the seed than in the vegetative portion as a result of the higher percentage of oil and protein in the seed.

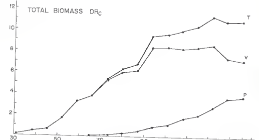

Fig. 36 Total biomass dry weight (T) partitioning into vegetative (V) and pod (P) components for control treatment on Dixie Runner peanut during the 1979 growing season.

The final growth phase covers the last 3 weeks before harvest. This phase was characterized by a reduction in the total biomass of the plants (Fig. 36). During this phase the LAI decreased (Fig. 36). The leaf and stem dry weights also decreased (Table 18). The pod-growth rate, however, continued to increase at a linear rate until harvest (Fig. 36).

The pod-growth rate of DR_C calculated from day 73 to day 108 was 45.7 kg/ha/day (Tables 31 and 33). The equation for this relationship is $y = -3348 + 45.7x$ with a coefficient of determination of 0.976 and a standard error of the slope estimate of 16 kg/ha/day. The final yield was 3758 kg/ha/day, the lowest of all the treatments studied (Table 31).

In the DR_{45} treatment, the reduction in photosynthate available for vegetative growth was demonstrated by the flower count decline which began after day 73 (Fig. 26). The LAI plateaued by this time and increased sharply to 9.9 by day 54 (Fig. 23) and plateaued again for 5 weeks. At day 122 from planting the LAI decreased slowly until harvest. The leaf dry weight decreased after day 122 (Table 19). The stem elongation slowed (Fig. 38) and the stem dry weight increase slowed (Table 19). The pod count stabilized at approximately 91 pods per plant by day 101 after planting (Fig. 30). The total biomass-growth rate decreased due to plant senescence leaf loss and the fact that more photosynthate is required in the production of dry matter in the seed than in the vegetative portion as a result of the higher percentage of oil and protein in the seed.

The final growth phase covers the last week (Fig. 37). This phase was characterized by a decrease in the vegetative components. The pod-growth rate continued to increase at a linear rate until harvest (Fig. 37).

of 0.59 and a standard error of the slope estimate of 7 kg/ha/day. The equation for DR_{87} is $y = -6672 + 164.0x$ with a coefficient of determination (r^2) of 0.94 and a standard error of the slope estimate of 27 kg/ha/day. This period from day 59 to day 94 was during the linear growth pahse and 3 weeks after seed development began. These growth rates may be used to estimate the amount of photosynthesis available for crop growth. During this period the canopy was not greatly affected by insect attack or disease.

After day 73, the seeds of Dixie Runner began to fill and the development of the plants began to shift from total vegetative growth to partial reproductive growth (Tables 18, 19, 20). As the pod count increased and the plants partitioned more of the available photosynthate into the reproductive component, the vegetative components began to decrease in rate of growth due to lack of photosynthate.

In the DR_C treatment, the reduction in photosynthate available for vegetative growth was demonstrated by the flower-count decline which began after day 73 (Fig. 26). The LAI plateaued by this time (Fig. 22). The leaf dry weight plateaued by day 87 (Table 18). The pod count stabilized at approximately 39 pods per plant by day 101 (Fig. 30). The stem elongation slowed (Fig. 34) and the stem dry weight stopped increasing (Table 18) by day 115. The total biomass curve slowed in rate of increase about day 94 (Fig. 36). The total biomass growth rate decreased due to leaf loss and also because more photosynthate is required in the production of dry matter in the seed than in the vegetative portion as a result of the higher percentage of oil and protein in the seed.

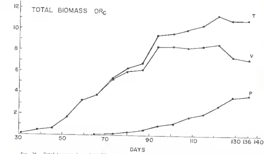

Fig 36 Total biomass dry weight (T) partitioning into vegetative (V) and pod (P) components for control treatment on Dixie Runner peanut during the 1979 growing season

The final growth phase covers the last 3 weeks before harvest. This phase was characterized by a reduction in the total biomass of the plants (Fig. 36). During this phase the LAI decreased (Fig. 36). The leaf and stem dry weights also decreased (Table 18). The pod-growth rate, however, continued to increase at a linear rate until harvest (Fig. 36).

The pod-growth rate of DR_C calculated from day 73 to day 108 was 45.7 kg/ha/day (Tables 31 and 33). The equation for this relationship is $y = -3348 + 45.7x$ with a coefficient of determination of 0.976 and a standard error of the slope estimate of 16 kg/ha/day. The final yield was 3758 kg/ha/day, the lowest of all the treatments studied (Table 31).

In the DR_{45} treatment, the reduction in photosynthate available for vegetative growth was demonstrated by the flower count decline which began after day 73 (Fig. 26). The LAI plateaued by this time and increased sharply to 5.9 by day 94 (Fig. 23) and plateaued again for 5 weeks. At day 122 from planting the LAI decreased slowly until harvest. The leaf dry weight decreased after day 122 (Table 19). The stem elongation slowed (Fig. 38) and the stem dry weight increase slowed (Table 19). The pod count stabilized at approximately 91 pods per plant by day 101 after planting (Fig. 30). The total biomass-growth rate decreased due to plant senescence leaf loss and the fact that more photosynthate is required in the production of dry matter in the seed than in the vegetative portion as a result of the higher percentage of oil and protein in the seed.

The final growth phase covers the last week (Fig. 37). This phase was characterized by a decrease in the vegetative components. The pod-growth rate continued to increase at a linear rate until harvest (Fig. 37).

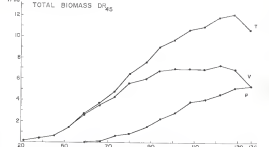

Fig 37. Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for DR_{45} treatment on Dixie Runner peanut during the 1979 growing season

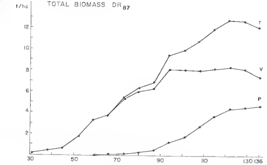

Fig 38 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for DR_{87} treatment on Dixie Runner peanut during the 1979 growing season

Table 18. Average weekly dry weight of components of Dixie Runner (DR$_C$) peanuts during the 1979 growing season.

Day	Total	Leaf	Stem	Root	Pod	Seed	Shelling
	----------	----------	g	----------	----------	----------	%
31	1.8	0.9	0.7	0.2			
38	6.3	3.3	2.4	0.6			
46	7.6	4.3	3.2	0.1			
52	15.8	8.1	7.2	0.4			
59	32.9	15.9	16.4	0.6	0.0		
66	48.7	23.6	24.6	0.2	0.2		
73	57.9	25.9	29.5	0.9	1.4	0.1	6
80	50.7	22.8	25.4	0.7	1.6	0.5	32
87	86.3	33.8	41.4	0.8	8.2	3.1	38
94	90.0	34.2	43.5	1.2	11.2	4.5	41
101	80.1	29.1	26.8	0.4	13.6	6.02	44
108	124.7	41.7	57.5	0.9	24.4	11.2	46
115	86.3	25.8	37.8	0.6	22.0	14.3	65
122	97.5	29.5	38.1	0.5	22.4	19.5	66
129	96.4	22.8	35.7	0.9	36.9	25.9	81
136	104.9	13.8	33.6	1.1	30.4	26.3	86

Table 19. Average weekly dry weight of components of Dixie Runner (DR_{45}) peanuts during the 1979 growing season.

Day	Total	Leaf	Stem	Root	Pod	Seed	Shelling
	----------	----------	----------	g	----------	----------	%
31	1.8	0.9	0.7	0.2			
38	6.3	3.2	2.3	0.6			
45	7.6	4.3	3.2	0.6			
52	10.2	5.3	4.6	0.2			
59	18.7	9.2	8.9	0.2	0.1		
66	38.1	18.9	18.9	0.5	0.4		
73	49.6	23.4	23.2	1.0	1.9	0.1	7
80	59.4	28.3	27.0	1.2	2.7	0.8	30
87	59.5	25.3	21.7	1.5	10.9	5.6	51
94	105.8	45.3	40.4	1.4	17.6	6.2	35
101	75.8	25.7	26.1	0.8	23.0	9.1	39
108	174.6	62.6	63.5	2.2	46.2	28.5	61
115	149.1	45.3	54.5	0.8	48.5	26.5	54
122	177.1	56.2	58.1	1.3	61.4	33.3	54
129	165.2	30.8	56.8	1.3	66.2	38.9	59
136	157.8	23.6	63.3	1.5	69.4	43.3	61

Table 20. Average weekly dry weight of componentsof Dixie Runner (GR87) during the 1979 growing season.

Day	Total	Leaf	Stem	Root	Pod	Seed	Shelling
	----------	----------	---------- g	----------	----------	----------	%
31	1.8	0.9	0.7	0.2			
38	6.2	3.2	2.4	0.6			
45	7.6	4.3	3.1	0.1			
52	15.8	8.1	7.2	0.4			
59	32.9	15.9	16.4	0.5			
66	48.6	23.6	24.6	0.2	0.2		
73	57.9	26.9	29.5	0.9	1.4	0.1	5
80	50.6	22.8	25.4	0.7	1.6	0.5	31
87	84.2	33.8	41.4	0.8	8.2	3.1	38
94	87.5	34.5	36.4	1.1	15.3	3.3	22
101	125.3	58.7	47.9	0.9	17.6	6.1	35
108	111.5	41.4	42.3	1.3	26.4	14.2	54
115	134.2	42.1	50.9	0.4	40.6	23.2	57
122	121.8	32.8	38.5	0.8	49.7	28.8	58
129	123.4	25.8	63.3	1.4	52.9	33.9	64
136	136.8	21.4	57.7	1.5	56.1	38.4	68

The pod-growth rate calculated from day 73 to day 108 was 94.2 kg/ha/day (Tables 31 and 33). The equation for this relationship is $y = -6565.87 + 94.2x$ with a coefficient of determination of 0.98 and a standard error of the slope estimate of 11 kg/ha/day. The final yield was 5310 kg/ha/day, comparable to that of Florunner control.

In DR_{g7} treatment, the reduction in photosynthate available for vegetative growth was demonstrated by the flower-count decline which began after day 73 (Fig. 26). The LAI plateaued by this time but increased to 8.1 by day 94 (Fig. 23) and plateaued again for 5 weeks. At day 122 after planting, the LAI decreased slowly to 4.4 at harvest. The leaf dry weight decreased after day 122 (Table 19). The stem elongation slowed (Fig. 34) and the stem dry weight increase slowed (Table 19). The pod count stabilized at approximately 91 pods per plant by day 101 (Fig. 30).

The total biomass curve slowed in rate of increase about day 101 (Fig. 38). The total biomass-growth rate decreased due to leaf loss and also because more photosynthata is required in the production of dry matter in the seed than in the vegetative portion as a result of the higher percentage of oil and protein in the seed.

The final growth phase covered the last 2 weeks (Fig. 38). This phase was characterized by a decrease in the vegetative components. The pod-growth rate continued to increase at a linear rate until harvest (Fig. 38).

The pod-growth rata calculated from day 73 to day 108 was 75.6 kg/ha/day (Tables 31 and 33). The equation for this relationship was $y = -5731 + 75.6x$ with a coefficient of determination of 0.93 and a standard error of the slope estimate of 16 kg/ha/day. The final yield was 4726 kg/ha (Table 31).

The growth of Florunner followed a sigmoid curve (Figs. 39, 40, 41). The early geometric phase covered approximately the first 7 weeks. The dry weight percentage followed a similar pattern to the other peanut cultivars (Tables 28, 29, 30). The leaf component was the largest, reaching 59.8% for FR_C and FR_{87}, and for FR_{45} 57.0% of the plant dry weight. The root percentage was initially 14.3% for all treatments (Tables 28, 29, 30) then decreased with time. The stem component was 35.7% for FR_C and FR_{87} (Tables 28 and 30) and 35.3% for FR_{45} (Table 29) at the first sampling date increased to 45.8, 46.7, and 47% for FR_{87}, FR_{45}, and FR_C, respectively, by the end of the geometric growth phase.

The linear growth phase began about 7 weeks after planting. The crop-growth rate from 59 to day 94 was 179.2 kg/ha/day for FR_C, 179.0 kg/ha/day for FR_{45}, and 179.3 kg/ha/day for FR_{87} (Tables 31 and 33). The equation for this relationship for FR_C was $y = -7472.8 + 179.29x$ with a coefficient of determination of 0.97 and standard error of the slope estimate of 13 kg/ha/day. The equation for the relationship for FR_{45} was $y = -7417.6 + 179.00x$ with a coefficient of determination of (r^2) of 0.96 and a standard error of the slope estimate of 12 kg/ha/day. The equation for the relationship of FR_{87} was $y = -7474 + 179.31x$ with a coefficient of determination of 0.97 and a standard error of the slope estimate of 13 kg/ha/day. The period from day 50 to day 94 was during the linear growth phase and 2 weeks after significant seed development. All Florunner treatments began to fill seeds about day 66 (Tables 21, 22, 23). As the pod count increased and more photosynthate was partitioned into seed filling, less was available for vegetative growth. Florunner control had a much higher pod yield than Dixie Runner control. The increased photosynthate requirement for the higher yield meant that

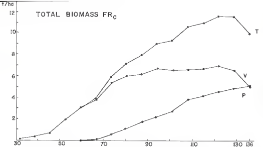

Fig 39 Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for control treatment on Florunner peanut during the 1979 growing season

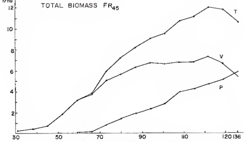

Fig. 40. Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for FR_{45} treatment on Florunner peanut during the 1979 growing season.

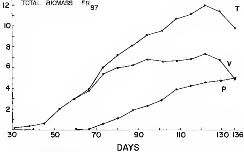

Fig 41. Total biomass dry weight (T) partitioned into vegetative (V) and pod (P) components for FR_{87} treatment on Florunner peanut during the 1979 growing season.

even less photosynthate was available for vegetative growth. This was evident in the complete cessation of flowering about day 94. Also stem elongation ceased by about day 101 (Fig. 36) in all Florunner treatments. The stem weight for Florunner stopped increasing about day 94 (Table 21) in FR_C, day 108 in treatments FR_{45} and FR_{87} (Tables 22 and 23) which might be delayed by the effect of Kylar, however this was earlier than Dixie Runner. The LAI began to decrease 2 weeks earlier in Florunner, compared to the older cultivar. The LAI was below that required for full ground cover in FR_C at harvest whereas FR_{45} had an LAI of 3.6 and FR_{87} had 3.0 (Fig. 23). The leaf dry weight decreased after day 122 (Table 19). The stem elongation slowed (Fig. 34) and the stem dry weight increase slowed (Table 19). The pod count stabilized at approximately 91 pods per plant by day 101 (Fig. 30).

The total biomass curve slowed in rate of increase about day 101 (Fig. 38). The total biomass-growth rate decreased due to leaf loss and also because more photosynthate is required in the production of dry matter in the seed than in the vegetative portion as a result of the higher percentage of oil and protein in the seed.

The final growth phase covers the last 2 weeks (Fig. 38). This phase was characterized by a decrease in the vegetative components. The pod-growth rate continued to increase at a linear rate until harvest (Fig. 38).

The pod-growth rate calculated from day 73 to day 108 was 75.6 kg/ha/day (Tables 31 and 33). The equation for this relationship was $y = -5731 + 75.6x$ with a coefficient of determination of 0.53 and a standard error of the slope estimate of 16 kg/ha/day. The final yield was 4726 kg/ha (Table 31).

Table 21. Average weekly dry weight of components of Florunner (FR$_C$) peanuts during the 1979 growing season

Day	Total	Leaf	Stem	Root	Pod	Seed	Shelling
	------------	------------	------------	g	------------	------------	%
31	1.9	0.9	0.6	0.2			
38	4.5	2.3	1.7	0.5			
45	7.9	4.8	3.0	0.2			
52	13.5	7.7	5.4	0.5			
59	23.6	11.1	12.0	0.3	0.2		
66	40.9	19.5	19.2	0.3	1.8	0.2	9
73	48.3	21.0	22.1	0.7	4.4	0.9	21
80	55.2	21.0	23.2	0.6	10.2	3.7	36
87	67.7	22.6	28.3	0.6	16.2	8.2	50
94	91.9	28.7	33.8	1.2	28.3	17.3	62
101	93.8	28.3	29.4	0.6	36.4	22.6	62
108	94.8	23.3	28.0	1.3	42.1	27.5	65
115	70.0	12.1	22.5	0.2	34.6	24.2	70
122	84.1	15.5	17.3	0.5	50.8	39.4	78
129	87.1	14.2	20.6	1.2	50.9	44.0	86
136	102.6	14.1	30.2	1.2	57.2	49.7	87

Table 22. Average weekly dry weight of components of Florunner (FR_{45}) during the 1979 growing season

Day	Total	Leaf	Stem	Root	Pod	Seed	Shelling
	g						%
31	1.9	0.9	0.7	0.3			
38	4.5	2.3	1.7	0.5			
45	7.9	4.8	3.0	0.2			
52	12.7	6.8	5.2	0.6			
59	24.1	10.7	12.8	0.4	0.2		
66	29.7	13.1	13.9	0.3	2.4	0.3	16
73	43.1	15.8	15.9	0.9	10.4	2.6	25
80	61.7	23.7	25.8	0.6	11.7	4.1	35
87	75.0	21.1	37.5	0.8	15.6	7.5	49
94	60.5	24.2	17.5	0.6	18.0	11.6	64
101	73.4	18.2	18.7	0.3	26.1	14.0	54
108	103.2	25.1	29.1	1.5	47.3	29.9	63
115	74.4	14.9	22.0	0.5	36.8	25.0	68
122	79.3	19.4	13.8	0.5	45.5	31.9	70
129	100.9	21.1	16.6	1.2	61.9	45.8	74
136	124.9	17.5	36.9	1.2	69.3	59.7	86

Table 23. Average weekly dry weight of components of Florunner (FR87) peanuts during the 1979 growing season.

Day	Total	Leaf	Stem	Root	Pod	Seed	Shelling
	g						%
31	1.9	0.9	0.6	0.3			
38	4.5	2.3	1.7	0.5			
45	7.9	4.8	3.0	0.2			
52	13.6	7.7	5.4	0.5			
59	23.6	11.1	12.0	0.3	0.2		
66	40.9	19.5	19.2	0.3	1.8	0.2	9
73	48.3	21.0	22.1	0.7	4.4	0.9	21
80	55.2	21.0	23.2	0.6	10.2	3.7	36
87	67.7	22.6	28.3	0.6	16.2	8.2	50
94	91.4	40.6	28.6	0.4	21.7	13.0	59
101	73.7	22.1	24.5	0.4	26.7	16.8	63
108	118.2	38.1	31.4	1.4	47.3	29.4	62
115	82.5	21.2	24.3	0.2	36.8	25.4	69
122	63.3	14.2	8.4	0.4	40.8	22.8	56
129	80.4	14.7	14.5	1.2	50.9	36.8	72
136	115.6	15.9	31.0	1.1	67.4	57.3	85

Table 24 Effect of Kylar on main-stem and branches for the different treatments during the 1979 growing season.

Treatments	Main-stem Average	Main-stem % of Control	Main-stem Reduction	Branches Average	Branches % of Control	Branches Reduction
	cm		%	cm		%
Dixie Runner						
DR$_C$	46.5	100	0	618.7	100	0
DR$_{45}$	33.1	71	(-)29	510.1	82	(-)17
DR$_{87}$	38.7	83	(-)17	504.3	81	(-)18
Florunner						
FR$_C$	30.5	100	0	370.5	100	0
FR$_{45}$	27.1	89	(-)11	370.5	100	0
FR$_{87}$	27.2	89	(-)11	419.7	111	(+)11

(+) more than the control.

(-) less than the control.

Table 25. Root, stem, leaf, and pod dry weight percentages for Dixie Runner (DRc) peanuts during the 1979 growing season.

Day	Root	Stem	Leaf	Pod
	------- Proportion of total weight, % -------			
31	11.8	38.0	50.0	
38	10.0	38.2	51.8	
45	1.0	41.5	56.8	
52	2.0	45.6	51.6	
59	2.0	49.7	48.3	0.1
66	0.5	50.6	48.5	0.4
73	2.0	51.0	44.7	2.4
80	1.5	50.2	45.0	3.2
87	0.9	47.9	39.2	9.4
94	1.3	48.3	37.9	12.4
101	0.6	46.0	36.3	17.0
108	0.7	46.1	33.4	19.5
116	0.7	29.9	29.9	25.5
122	0.5	39.0	30.2	30.9
129	0.9	37.0	23.6	38.3
136	1.0	51.1	13.3	34.4

Table 26. Root, stem, leaf, and pod dry weight percentages for Dixie Runner (DR_{45}) peanuts during the 1979 growing season.

Day	Root	Stem	Leaf	Pod
	------- Proportion of total weight, % -------			
31	11.0	38.0	50.5	
38	10.0	37.9	51.8	
45	7.0	41.4	56.9	
52	2.3	45.3	52.2	
59	1.3	47.9	49.2	0.5
66	1.6	49.8	49.7	1.0
73	2.2	46.7	47.2	3.9
80	2.0	45.5	47.8	4.6
87	2.6	36.5	42.6	18.3
94	1.4	38.1	42.8	16.6
101	1.1	34.4	34.0	30.4
108	1.2	36.4	35.9	26.4
115	0.5	36.5	30.4	32.5
122	0.7	32.8	31.7	34.7
129	0.8	36.6	19.8	42.8
136	0.9	40.1	14.9	43.9

Table 27. Root, stem, leaf, and pod dry weight percentages for Dixie Runner (DR$_{87}$) peanuts during the 1978 growing season

Day	Root	Stem	Leaf	Pod
	------- Proportion of total weight, % -------			
31	11.9	38.0	50.0	
38	10.0	37.9	51.6	
45	1.0	41.4	57.0	
52	2.0	45.5	51.5	
59	2.0	49.7	48.3	0.1
66	0.5	50.5	48.5	0.4
73	2.0	51.0	44.7	2.5
80	1.5	50.2	45.0	3.2
87	1.0	49.1	40.1	9.7
94	1.3	41.6	39.5	17.5
101	0.7	38.2	46.8	14.0
108	1.2	37.9	37.1	23.7
115	0.3	37.9	31.4	30.2
122	0.6	31.6	26.8	40.8
129	1.1	51.2	20.8	42.8
136	1.1	42.2	15.6	41.0

The growth of Florunner followed a sigmoid curve (Figs. 39, 40, 41). The early geometric phase covered approximately the first 7 weeks. The dry weight percentage followed a similar pattern to the other peanut cultivars (Tables 28, 29, 30). The leaf component was the largest, reaching 59.9% for FR$_C$ and FR$_{87}$, and for FR$_{45}$ 57.0% of the plant dry weight. The root percentage was initially 14.3% for all treatments (Tables 28, 29, 30), then decreased with time. The stem component was 35.7% for FR$_C$ and FR$_{87}$ (Tables 28 and 30) and 35.3% for FR$_{45}$ (Table 29) at the first sampling date increased to 46.8, 46.7, and 47% for FR$_{87}$, FR$_{45}$, and FR$_C$, respectively, by the end of the geometric phase.

The pod-growth rate calculated from day 73 to day 108 was 90.3 kg/ha/day for FR$_C$ (Tables 31 and 33). The equation for this relationship was $y = -6025.87 + 90.3x$ with a coefficient of determination (r^2) of 0.99 and a standard error of the slope estimate of 11 kg/ha/day. The final yield was 5051 kg/ha (Table 36). The pod-growth rate for FR$_{45}$ was 83.1 kg/ha (Tables 31 and 33). The equation for this relationship was $y = -5301.48 + 83.1x$ with a coefficient of determination of 0.96 and a standard error of the slope estimate of 13 kg/ha/day. Plants from the FR$_{87}$ treatment also had a pod growth rate of 90.1 kg/ha/day (Tables 31 and 33). The equation for this relationship was $y = -6012.76 + 90.1x$ with a coefficient of determination of 0.97 and a standard error of the slope estimate of 11 kg/ha/day. Florunner$_{45}$ had the lowest pod growth rate.

The fruit development became a significant factor at about the 73rd day after planting. In the evaluation of the pod number data, it should be kept in mind that the basic concept was that the crop-

Table 28 Root, stem, leaf, and pod dry weight percentages for Florunner (FR_C) peanuts during the 1979 growing season.

Day	Root	Stem	Leaf	Pod
	------- Proportion of total weight, % -------			
31	14.3	35.7	49.7	
38	11.3	37.9	50.8	
45	2.4	37.7	59.9	
52	3.5	39.8	56.6	
59	1.2	50.7	47.0	0.1
66	0.7	47.0	47.8	4.7
73	1.4	45.8	43.5	9.2
80	1.2	42.0	38.2	18.4
87	0.9	41.7	33.3	23.9
94	1.2	36.7	31.1	30.8
101	0.6	31.3	30.2	38.9
108	1.4	29.5	24.5	44.4
115	0.2	32.1	18.2	49.3
122	0.6	20.6	18.3	60.3
129	1.4	23.7	16.3	58.4
136	1.1	29.4	13.7	55.7

Table 29 Root, stem, leaf, and pod dry weight percentages for Florunner (FR45) peanuts during the 1979 growing season.

Day	Root	Stem	Leaf	Pod
	------- Proportion of total weight, % -------			
31	14.2	35.3	49.2	
38	11.3	37.9	50.7	
45	2.3	37.7	59.9	
52	4.6	41.1	53.9	
59	1.7	52.9	44.1	1.1
66	0.9	46.7	44.0	8.1
73	2.1	36.9	36.6	24.1
80	0.9	41.7	38.3	18.9
87	1.1	50.0	28.1	20.7
94	1.0	29.0	40.0	29.8
101	0.4	25.5	24.8	35.6
108	1.5	28.2	24.3	45.8
115	0.7	29.6	20.1	49.5
122	0.6	17.4	24.5	57.3
129	1.1	16.4	20.9	61.3
136	0.9	29.5	14.0	55.4

Table 30. Root, stem, leaf, and pod dry weight percentages for Florunner (FR_{87}) peanuts during the 1979 growing season

Day	Root	Stem	Leaf	Pod
	------- Proportion of total weight, % -------			
31	14.3	35.7	49.7	
38	11.3	37.9	50.8	
45	2.4	37.7	59.9	
52	3.5	39.8	56.6	
59	1.2	50.7	47.0	0.1
66	0.7	45.8	47.8	4.7
73	1.4	42.0	43.5	9.2
80	1.2	41.7	38.2	18.4
87	0.9	36.7	33.3	23.9
94	0.4	31.2	44.3	23.7
101	0.5	33.2	29.9	36.2
108	1.2	26.5	32.2	40.0
115	0.2	29.4	25.6	44.6
122	0.6	13.3	22.5	64.4
129	1.5	18.1	18.2	63.3
136	1.0	26.8	13.7	58.3

Table 31 Crop-growth rates, pod-growth rates, partitioning factors, and final yields for the different treatments during the 1979 experiment.

Treatments	Crop-growth rate ± SEE	r^2	Days	Pod-growth rate ± SEE	r^2	Days	Partitioning Factor	Final Yield
	kg/ha/day			kg/ha/day				kg/ha
Dixie Runner								
DR_C	164.0 ± 20	.94	59-94	45.7 ± 16	.97	73-108	45.9	3758c
DR_{45}	180.0 ± 7	.99	59-94	94.2 ± 11	.98	73-108	86.4	5314a
DR_{87}	163.8 ± 27	.94	59-94	75.6 ± 16	.93	73-108	76.1	4726b
Florunner								
FR_C	179.2 ± 13	.97	59-94	90.3 ± 11	.97	73-108	83.1	5051ab
FR_{45}	179.0 ± 12	.97	59-94	83.1 ± 13	.96	73-108	77.8	5341a
FR_{87}	179.3 ± 13	.97	59-94	90.1 ± 11	.97	73-108	82.94	4989b

* Treatments with different letters are significantly different. Largest values designated by "a".

Table 32. Pod number increase rate, average pod weight, filling period, and shelling percentage for Dixie Runner and Florunner when Kylar was applied at different growth stages in 1979.

Treatments	Pod number increase rate	Average pod weight	Filling period	Shelling percentage
	no/m^2/day	g	days	%
Dixie Runner				
DR_C	8.3	0.76	81	86.6
DR_{45}	35.3	0.74	57	61.0
DR_{87}	28.9	0.85	63	68.5
Florunner				
FR_C	21.7	0.99	56	87.0
FR_{45}	21.3	1.00	64	86.2
FR_{87}	22.8	1.04	55	85.0

growth rate is not substantially affected by suppressing the vegetative growth. The data for the crop-growth rates in Tables 31 and 33 support this concept. Crop-growth rates did not differ significantly between and within cultivars.

The Kylar-treated Dixie Runner (DR_{45} and DR_{87}) showed a linear increase in pod number from day 59 to 101 (Fig. 30) then stabilized until harvest. Data for the Dixie Runner control (DR_C) produced a linear increase in pod number from day 59 to 94 only (Fig. 30) and stabilized until harvest. The pod-growth rate and the total pod number in the Dixie Runner control seemed to be sufficient to utilize all the photosynthate partitioned for reproductive growth, thus, a stable pod number was established at this time.

Dixie Runner initially has a lower pod-growth rate (Table 31), if the vegetative growth is suppressed, the surplus photosynthate will be available which will enable the plant to set more pods. The data showed that this was indeed the case where vegetative growth was suppressed by the application of Kylar.

The period between establishment of a closed leaf canopy and the beginning of the filling period was used to determine the crop-growth rate. Figs. 36, 37, 38, 39, 40, and 41 showed the rate of accumulation of dry weight for each treatment within the two cultivars. By inspection of these data it is obvious that from day 59 after planting to about day 94, while growth was essentially linear, crop-growth rates did not differ significantly among the peanut cultivar treatments.

The method used to estimate the crop-growth rate was to fit a linear regression to the dry-weight data for each of the treatments for the period of linear growth. The regression equations for each treatment are shown in Table 33. All treatments grew at a nearly constant rate from canopy closure, day 59 until the 94th day after planting. The calculated crop-growth rate, along with the coefficient of determination (r^2) and the SEE are in Tables 31 and 33.

The insignificantly higher crop-growth rates for the 45 day, Kylar-treated Dixie Runner and for all Florunner treatments are in agreement with work by Bhagsari and Brown (1976) who found Florunner to have a higher rate of leaf photosynthesis than any other cultivar of peanuts tested. This was indeed the case in 45 day, Kylar-treated Dixie Runner where Kylar was applied at constant intervals from flowering until maturity phase. As mentioned above, the leaves of peanuts treated with Kylar appeared greener than controls. Along with this color the leaves became thicker (Fig. 24). In this study no measurements of photosynthetic rates were taken, however, consistent works, in agreement with these facts, have been reported by Brittain (1967) who found that leaves of peanut plants treated with Kylar appeared greener and contained a higher concentration of chlorophyll than controls, that rates of net CO_2 assimilation were increased by Kylar treatment when the plants were densely spaced, and by Perry (1972) who noted similar dark greening of peanut plants when treated with Kylar, just as the plant normally began to lose some of its lush green color. He postulated that the color effect is apparently caused by an increase in chlorophyll, which could make the plant more efficient in interrupting and using the sun's energy.

Partitioning of Assimilates

Partitioning is a day-to-day process that was not measured directly but which was estimated by comparing reproductive and vegetative growth

Table 33 Regression equation analyses for the crop-growth rate and pod-growth rate of Dixie Runner and Florunner during the 1979 growing season

Treatments	Crop-growth rate ± SEE	Pod-growth rate ± SEE
	kg/ha/day	kg/ha/day
Dixie Runner		
DR_C	$y = -6704.08 + 164.27x \pm 20 \quad r^2 = 0.94$	$y = -3348.85 + 45.77x \pm 16 \quad r^2 = 0.97$
DR_{45}	$y = -8040.66 + 180.00x \pm 7 \quad r^2 = 0.99$	$y = -6566.87 + 94.21x \pm 11 \quad r^2 = 0.98$
DR_{87}	$y = -5672.01 + 163.80x \pm 27 \quad r^2 = 0.94$	$y = -05731.34 + 75.60x \pm 16 \quad r^2 = 0.93$
Florunner		
FR_C	$y = -7472.81 + 179.29x \pm 13 \quad r^2 = 0.97$	$y = -6025.87 + 90.30x \pm 11 \quad r^2 = 0.97$
FR_{45}	$y = -7468.71 + 179.00x \pm 12 \quad r^2 = 0.98$	$y = -5301.48 + 83.13x \pm 13 \quad r^2 = 0.96$
FR_{87}	$y = -7474.21 + 179.31x \pm 13 \quad r^2 = 0.97$	$y = -6013.76 + 90.14x \pm 11 \quad r^2 = 0.97$

Partitioning was defined by Duncan et al. (1978) as the division of recent assimilate between reproductive and vegetative plant parts. They estimated less than 50% of recent assimilates were being used for fruit growth at the end of the fruit-loading period for the lower-yielding peanut cultivar, while for the higher-yielding peanut cultivar, about 90% of recent assimilates were being used for fruit growth as the plant completed its fruit loading. The partitioning factors for all treatments are shown in Table 31

The DR$_{45}$ treatment had the highest partitioning factor of 86.4% followed by FR$_C$ and FR$_{87}$ treatments with 83.10 and 82.94%, respectively There were no significant differences between the two treatments in partitioning assimilates to reproductive parts. There were also no significant differences between FR$_{45}$ and DR$_{87}$ treatments with 77.8 and 76.1%, respectively. The DR$_C$ treatment, Dixie Runner control, had 45.9%, the lowest partitioning factor among all treatments.

The leaf canopies of all peanut cultivars remained in good condition with LAI's above 3.0 until well into their filling period (Figs. 22 and 23). Therefore, the rates of net photosynthesis per unit of land area remained nearly constant at the values calculated for the period from the day 59 to 94. In this study the rate of increase in pod number varied between and within cultivars (Table 32). The linear addition of new pods was uninterrupted until the final number of pods was attained (Figs. 30 and 31)

The partitioning factor is a ratio of the amount of photosynthesis partitioned to the yield component of the crop divided by the total amount of photosynthate available for the crop growth. It can be estimated using the pod growth rate corrected for the increased oil and protein in the seed divided by the crop-growth rate. The correction factor of 1.65 as calculated by McGraw (1977) was used.

Filling Period

The duration of the filling period here was set by the capacity of the pod, which reaches its full size while the ovules within are still small, and by the nearly constant growth rate of the ovule. When the growing ovule gets large enough to fill completely the relatively inelastic pod, growth must cease (Duncan et al., 1978).

Duncan et al. (1978) stated that one determinant of the length of the filling period of an individual pod is the relationship between pod capacity and ovule-growth rate. In Dixie Runner cultivar, there were no positive correlations between yield and the length of filling period (Table 32). The DR_C treatment, the lowest yielding treatment, had 81 days, the longest filling period. The DR_{45} treatment, the highest yielding, had the shortest filling period of 57 days. Treatment DR_{87}, the third in terms of yield, had 63 days filling period. In Florunner, however, the yield and duration of filling period were positively correlated (Table 32). The highest yielding treatment, FR_{45}, had the longest filling period of 64 days, followed by the FR_C treatment with 56 days. The lowest-yielding treatment, FR_{87}, had the shortest filling period of 55 days.

Shelling Percentages

The shelling percentages for the different treatments are shown in Table 32. There were no significant differences among the Florunner treatments. In Dixie Runner treatments, however, there existed a wide range between the control and the Kylar-treated plants (Table 32). There were no significant differences between Dixie Runner control and the overall Florunner treatments. In both Florunner and Dixie Runner, the treatment controls had values of shelling percentage of 86.6 and 87.0% for DR_C and FR_C, respectively. The treatment DR_{45} had the lowest value of 61.0% for shelling percentage. The very high shelling percentages for DR_C and DR_{67} treatments were due to moisture intake by the seeds before weighing.

The average weights of a single pod for all treatments are shown in Table 32. The DR_{45} treatment had the lowest value of 0.74 g/pod. Lower shelling percentage and lower average weights of a single pod for DR_{45} treatment indicated that the growing ovule had not become large enough to fill completely the pod.

The long growing season in 1979 would probably permit the fruit of the DR_{45} treatment to reach maturity and hence achieve its full yield potential if the life cycle of the plants had not been shortened by a severe Cereospora leaf spot attack 3 weeks before harvest.

Yield Aspects

The two peanut cultivars initially differed significantly in pod yield (Table 31). The lowest yielding was Dixie Runner control (DR_C). It yielded 3760 kg/ha. The 87-day Kylar-treated Dixie Runner (DR_{87}) the next treatment in terms of lower yield, yielded 26% more pods than Dixie Runner control. The DR_{87} treatment had a pod yield of 4730 kg/ha followed by the 87-day Kylar-treated Florunner with 4940 kg/ha which count for 6% more pod yield than DR_{87} and 32% more than DR_C. The Florunner control (FR_C), the fourth in terms of lower yield, yielded 1.0% more than FR_{87}, 7% more than DR_{87}, and 34% more than DR_C. The 45-day Kylar-treated Florunner (FR_{45}) yielded 6% more pod than the Florunner control, 7.0% more pod than Florunner 87-day treatment, and

42% more than Dixie Runner control. The pod yield of the 45 day Kylar-treated Dixie Runner (DR_{45}) was comparable to that of FR_{45} treatment. The DR_{45} treatment had a pod yield of 5310 kg/ha as compared to 5340 kg/ha for FR_{45} treatment. The 87 day Kylar-treated Florunner cultivar had the lowest pod yield among the Florunner treatments while the FR_{45} treatment, the higher yielding, had the lower partitioning factor. There is no explanation for this phenomenon.

McGraw (1979) suggested there were three possible major physiological explanations for the tremendous yield increase in Florunner and Early Bunch cultivars: 1) the photosynthetic output of the newer cultivars could have been increased, 2) the filling period of the newer cultivars could have been increased, and/or 3) the partitioning factor could have been increased in the newer cultivars. The photosynthetic rates of the treatments were estimated by the crop-growth rates (Tables 31 and 33).

The crop-growth rates show that of the six treatments, the first two lowest-yielding treatments, DR_C and DR_{87} treatments, had the lowest crop-growth rates, 164 kg/ha/day each. The highest crop-growth rate was for the second highest yielder, DR_{45}, at 180 kg/ha/day. All Florunner treatments had the same crop-growth rate, at 173 kg/ha/day which did not differ significantly from that of DR_{45}. Since crop-growth rates are estimates of crop photosynthetic rates, it should be assumed that, though insignificant, the highest yielding treatments had higher rates of leaf photosynthesis which is in agreement with the findings by Brittain (1967) and Bhagsari and Brown (1976). This difference, however, was not sufficient to account for the striking increased yield of Kylar-treated Dixie Runner nor for the difference in yield between

Dixie Runner and Florunner cultivars. This conclusion was reinforced by analysis of the total dry matter produced by the plants. If an increased photosynthetic rate was responsible for the yield increase, it would be expected to have the greatest total dry-matter produced by the plants with the highest photosynthetic rates. Although the lowest production was by DR_C treatment, the lowest yielder, which reached 11,380 kg/ha, there were correlations between pod yield and total dry-matter production. The highest production was by DR_{87} which reached 12,790 kg/ha. DR_{45} produced a maximum of 12,070 kg/ha followed by FR_C which reached 12,020 kg/ha, and FR_{87} with 12,010 kg/ha. FR_{45} produced 11,720 kg/ha, which was the highest yielder. Thus, the increased yield by Kylar treatment cannot be explained by a difference in the photosynthetic rates only.

Another possible explanation was an increased filling period. The six peanut treatments all began flowering at about the same time and all reached harvest the same time. In this study, no positive correlations were found between yield and filling period (Table 32). This is consistent with the results of Gay et al. (1980) on soybeans. The lowest yielder, DR_C, had the longest filling period, 81 days, while the highest yielding Dixie Runner Kylar treatment had a shorter filling period of 57 days.

The physiological aspect that was most responsible for the increased yield by Kylar treatment was an increase in the partitioning factor. The partitioning factors for the six treatments were 0.86 for DR_{45}, 0.83 for FR_C and FR_{87}, 0.78 for FR_{45}, 0.76 for DR_{87}, and 0.46 for DR_C.

The yield advantage for Kylar-treated Dixie Runner in comparison with the control resulted from an increased number of fruit per unit area (Table 32) It has been suggested (Egli et al., 1978) that the number of seed produced by a soybean community is a function of the amount of photosynthate available for seed growth. The average rate of accumulation of total dry-matter by the shoot was similar for the three Dixie Runner treatments, even though DR$_{45}$ produced 41% and DR$_{87}$ 26% more pod yield than the control, DR$_C$. The data showed that from beginning of significant seed development until harvest, however, DR$_C$ produced more vegetative dry weight than DR45. From day 54 to harvest, DR$_C$ also produced more vegetative dry weight than DR$_{87}$. Inspection of Figs. 32 and 34 showed that Dixie Runner control, DR$_C$, continued growing vegetatively during the pod-filling period to produce more vegetative dry weight than Kylar-treated Dixie Runner, while producing approximately 41% less pod yield than the 45-day Kylar-treated Dixie Runner and 26% less than the 87-day Kylar treatment, suggesting that Kylar-treated Dixie Runner, whose vegetative growth was suppressed, was more efficient at partitioning photosynthate to the fruit than was the control

In comparing two pairs of old low-yielding Dixie Runner and new high-yielding Florunner cultivars, it became obvious that Dixie Runner exhibited an indeterminate growth habit and continuous flowering whereas Florunner was characterized by more determinate growth with flowering lasting for about 60 days The major difference between these two cultivars which results in the increased yield potential is associated with differences in partitioning of daily photosynthate to fruits. Florunner initially partitions about 80% of its photosynthate to the pods whereas Dixie Runner only partitions about 40%

The yield advantage for Kylar-treated Dixie Runner achieved by suppressing the vegetative growth resulted from an increase in the partitioning of photosynthate to fruits. Excessive vine growth of Dixie Runner possibly reduces yields due to channeling of energy into vegetative rather than reproductive growth.

SUMMARY AND CONCLUSIONS

During the 1978 and 1979 growing seasons, growth analyses were conducted to study the effect of Kylar (succinic acid-2,2-dimethylhydrazide) on low partitioning (Dixie Runner) vs. high partitioning (Florunner) peanut cultivars. The objective was to test the hypothesis that the use of Kylar to suppress the vegetative growth of low partitioning peanut (Dixie Runner) results in the increased partitioning of photosynthate from the vegetative plant parts to the fruits.

This study showed that Kylar had no effect on LAI, flower and peg initiation for both Dixie Runner and Florunner, however, it did slightly increase the SLW of Dixie Runner cultivar. This increase was related to the increase of leaf chlorophyll content which was believed to increase the photosynthetic rate per unit area. Kylar reduced the vegetative growth of both Dixie Runner and Florunner, but this reduction was more in the old cultivar (Dixie Runner) than the new one (Florunner). Dixie Runner exhibited an indeterminate growth habit whereas the new one is characterized by more determinate growth. No significant effect of Kylar was observed on crop-growth rates between and within cultivars. The average rate of accumulation of total dry-matter by the vegetative parts was similar for all treatments. However, Kylar did increase the pod-growth rate of Dixie Runner.

Partitioning of photosynthate was increased in Dixie Runner peanut by Kylar as evidenced by the increase in pod-growth rate, pod number, and by an increase in the yield of Dixie Runner peanuts. Kylar-treated

Dixie Runner produced comparable yield to treated and untreated Florunner cultivar.

The most striking response to the Kylar treatments was the marked increase in pod number in the indeterminate Dixie Runner cultivar.

The yield advantage for Dixie Runner treated with Kylar resulted from an increase in the number of fruits per unit area. The increase in the number of fruits apparently resulted from an increase in the partitioning of photosynthate to the fruits. The Dixie Runner control continued vegetative growth during the pod-filling period to produce more total vegetative weight. It produced less pod yield than the treated Dixie Runner which stopped growing vegetatively as a result of the Kylar treatment. This suggested that Kylar-treated Dixie Runner was more efficient at partitioning photosynthate to the fruits than was Dixie Runner control.

Kylar-treated Dixie Runner utilized energy for reproductive rather than vegetative growth as compared to the control which utilized the energy for vegetative rather than reproductive parts. This conclusion was supported by the fact that high partitioning, high-yielding new cultivars (Florunner and Early Bunch) characterized by more determinate growth stopped growing vegetatively after fruit establishment whereas the old cultivars (Dixie Runner and Early Runner) continued to grow until maturity (Duncan et al., 1978). Thus, the vegetative growth of the peanut is the key for partitioning of photosynthate to fruits

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APPENDIX A

TABLES OF RAW DATA: PEG NUMBER PER SQUARE METER IN 1978, FLOWER NUMBER PER PLANT IN 1979.

Table A-1. Effect of Kylar on peg number when applied at different growth stages of Dixie Runner peanut in 1978.

Days after planting	Treatment						
	DR_C	DR_{30}	DR_{44}	DR_{58}	DR_{72}	DR_{86}	DR_{100}
	pegs/m^2						
44	77	116					
58	413	503	464				
72	219	232	194	142			
86	439	722	697	400	529		
100	477	748	632	851	348	503	
114	52	0	129	90	168	142	129

Table A-2. Effect of Kylar on peg number when applied at different growth stages of Florunner peanut in 1978.

Days after planting	Treatments						
	FR_C	FR_{30}	FR_{44}	FR_{58}	FR_{72}	FR_{86}	FR_{100}
	pegs/m^2						
44	348	361					
58	658	619	670				
72	232	161	129	168			
86	767	735	270	335	490		
100	658	568	877	555	645	710	
114	90	12.9	39	194	26	26	12.9

Table A-3. Effect of Kylar on pod number when applied at different growth stages of Dixie Runner peanut in 1978 for the one-plant samples.

Days after planting	Treatment						
	DR_C	DR_{30}	DR_{44}	DR_{58}	DR_{72}	DR_{86}	DR_{100}
				pods/m^2			
58	103	168	168				
72	220	516	284	387			
86	374	490	503	529	529		
100	477	529	581	568	426	529	
114	387	568	413	477	284	361	374

Table A-4. Effect of Kylar on pod number when applied at different growth stages of the Dixie Runner peanut in 1978 for the three-plant samples.

Days after planting	Treatment						
	DR_C	DR_{30}	DR_{44}	DR_{58}	DR_{72}	DR_{86}	DR_{100}
	------------------ pods/m^2 ------------------						
58	77	90	129				
72	220	232	245	181			
86	361	46	452	426	503		
100	671	568	452	452	477	606	
114	335	400	387	400	335	250	297

Table A-5 Effect of Kylar on pod number when applied at different growth stages of Florunner peanut in 1978 for the one-plant samples.

Days after planting	Treatment						
	FR_C	FR_{30}	FR_{44}	FR_{58}	FR_{72}	FR_{86}	FR_{100}
	pods/m^2						
44	39	12.9					
58	258	220	271				
72	232	346	335	426			
86	568	490	542	439	632		
100	490	710	632	452	516	542	
114	284	361	323	323	477	477	439

Table A-6. Effect of Kylar on pod number when applied at different growth stages of Florunner peanut in 1978 for the three-plant samples.

Days after planting	Treatment FR_C	FR_{30}	FR_{44}	FR_{58}	FR_{72}	FR_{86}	FR_{100}
				pods/m^2			
58	194	181	220				
72	206	250	232	232			
86	452	374	464	387	490		
100	464	516	581	400	555	348	
114	310	310	297	284	374	284	297

Table A-7. Weekly flower count for Dixie Runner during the 1979 growing season.

Treat-ments	Days of Sampling																	
	31	38	45	52	59	66	73	80	87	94	101	108	115	122	129	136	Total	Mean
Dixie Runner																		
OR_C		5	7	19	26	55	62	46	45	13	15	8	7	6	2	1	317	21
DR_{45}		3	8	10	15	67	71	59	49	9	16	9	6	6	3	1	332	22
DR_{87}		4	7	18	25	54	70	47	46	12	16	3	9	7	7	5	330	22
Total		12	22	47	66	176	203	152	140	34	47	20	22	19	12	7	979	
Mean		4	7	16	22	59	68	51	47	11	16	7	7	6	4	2		22

Table A-8. Weekly flower count for Florunner during the 1979 growing season

Treat-ment	Days of Sampling																
	3	38	45	52	59	66	73	80	87	94	101	108	115	122	129	136	Total	Mean
Florunner																		
FR_C		4	10	18	28	51	44	27	4	1	0	1	1	0	0	0	189	13
FR_{45}		3	11	19	22	50	93	32	4	0	1	0	0	0	0	0	235	17
FR_{87}		4	10	18	28	51	44	27	4	0	0	0	0	0	0	0	186	12
Total		11	31	55	78	152	181	86	16	1	1	1	1	0	0	0	610	
Mean		4	10	18	26	51	60	29	4	0	0	0	0	0	0	0		18

APPENDIX B

COMPUTER OUTPUTS OVERLAID CURVES FOR TOTAL DRY WEIGHTS, VEGETATIVE DRY WEIGHTS, POD DRY WEIGHTS OF THE 1979 EXPERIMENTS

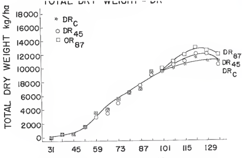

Fig. 5-1. Comparative total dry weight curves for Dixie Runner DR_C, DR_{45}, DR_{87}, during the 1979 growing season

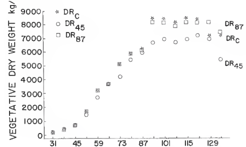

Fig. B-2. Comparative vegetative dry weight curves for Dixie Runner treatments: DR_C, DR_{45}, DR_{87}, during the 1979 growing season.

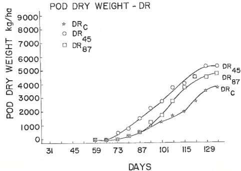

Fig. B-3 Comparative pod dry weight curves for Dixie Runner treatments: DR_C, DR_{45}, DR_{87}, during the 1979 growing season.

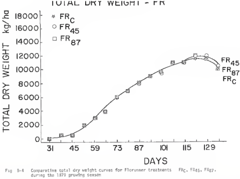

Fig B-4 Comparative total dry weight curves for Florunner treatments FR_C, FR_{45}, FR_{87}, during the 1979 growing season

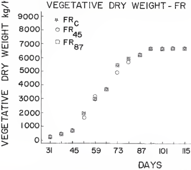

Fig 8-5. Comparative vegetative dry weight curves for Florunner treatments: FR_C, FR_{45}, FR_{87}, during the 1979 growing season.

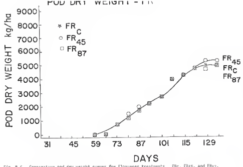

Fig B-6 Comparative pod dry weight curves for Florunner treatments FR_C, FR_{45}, and FR_{87}, during the 1979 growing season

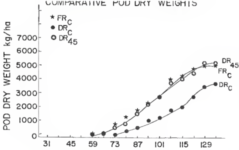

Fig 8-7 Comparative pod dry weight curves for Dixie Runner control, Dixie Runner DR_{45} treatment, and Florunner control during the 1979 growing season

BIOGRAPHICAL SKETCH

Oumar N'Diaye was born 3 May 1946 to Mamoudou and Fanta Souko N'Diaye in Kita, Republic of Mali. He became interested in agriculture at an early age and continued his interest through voluntary activities as a scout and later as a pioneer.

He attended elementary school in Kita, his home town, and junior high school and Askia Mohamed high school in Bamako, the capital of Mali.

Upon high school graduation in 1967, he enrolled in the University "Hohenheim", Stuttgart, Federal Republic of Germany, in 1968. He majored in Agronomy and received a Bachelor of Science in 1972. He immediately began a Master of Science program in crop production at Hohenheim University and received this degree in October 1974.

After graduation from the University of Hohenheim, he returned to his home country, Mali, and worked from February 1975 to August 1977 at the I.R.H.O. station. He came to Gainesville in September 1977 and enrolled in the English Language Institute at the University of Florida for 2 quarters. He began studies for the Doctor of Philosophy degree at the University of Florida in March 1978, with a minor in Soil Science.

Upon receiving the Ph.D., he expects to return to his country and contribute to its agricultural development. Oumar N'Diaye speaks fluently French, German, English, and Bambara (mother tongue). He is a member of the American Peanut Research and Education Society, The American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

DE McCloud

Darell E. McCloud
Chairman and Professor of Agronomy

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Professor of Soil Science

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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D H. Teem
Associate Professor of Agronomy

This dissertation was submitted to the Graduate Faculty of the College of Agriculture and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1980

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